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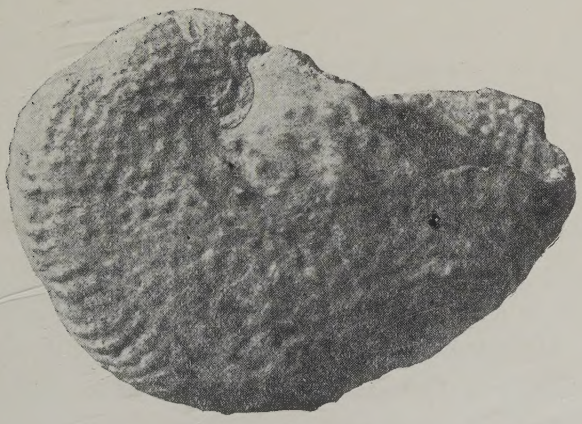

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CONTENTS

TRANSACTIONS

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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 31, pp. 223-229, pl. 32, Aug. 15, 1958.

341. ON THE MIOCENE PECTINIDAE FROM THE ENVIRONS OF SENDAI; PART 11, *PECTEN* (*CHLAMYS*) *CRASSIVENIUS* YOKOYAMA AND ITS RELATED SPECIES*

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仙台附近中新統産 Pectinidae; その 11, *Pecten* (*Chlamys*) *crassivenius* YOKOYAMA 及びその関連種について: 本種は非常に特徴的な模様を持つ種であるが, 模式標本が不完全なものであったため, 従来他種との間に多くの混乱があった。筆者は岩手県和賀郡和賀町岩沢上流の, 鈴鴨層より採集した多数の標本を基礎とし, 模式標本その他各地からの標本について検討して再記載を行い, 本種の持つ地質学的な意義を簡単に論じた。さらに筆者が最近茨城県北茨城市大津町五浦の九面層より採集した *crassivenius* に似た新種を記載し, *izurensis* と命名した。 増田孝一郎

Pecten (*Chlamys*) *crassivenius* was first described by M. YOKOYAMA based upon a single left valve lacking the apical region from the Nanao formation near Nanao City, Ishikawa Prefecture, and subsequently it has been reported from many localities of the Japanese Neogene Tertiary.

This species is of particular interest because of its peculiar sculpture, more or less restricted geological range and rather wide geographical distribution. The occurrence of *crassivenius* in formations of more or less similar lithology serve as important data in analysing its paleoecological conditions.

Lately the writer together with Mr. Kin-ichi NAKAYA, student of the Institute of Geology and Paleontology, Faculty of Science, Tohoku University, collected many specimens of *Pecten* (*Chlamys*) *crassivenius* from the Miocene Suzukamo formation in the upstream of the Iwasawa, Waga-machi, Waga-gun, Iwate Prefecture. And more recently he collected several interesting specimens resembling *crassivenius* from the Miocene Kokozura formation at Izura, Ôtsu-machi, Kita-Ibaraki City, Ibaraki Prefecture. Taking this opportunity, the writer wishes to describe the features of *crassivenius* and to describe a new species.

Numerous specimens preserved in the collections of the Department of Geology, Faculty of Education, Tohoku University, of the Institute of Geology and Paleontology, Faculty of Science, Tohoku University, and of the Saito Ho-on Kai Museum, all in Sendai City, and the holotype of *crassivenius* in the collection of the Institute of Geology, Faculty of Science, Tokyo University, were studied by the writer. The results of examination are presented herein.

Acknowledgements are due to Dr. Kotora HATAI of the Department of

* Received Oct. 18, 1957; read at 66th meeting of the Society at Akita, June 15, 1957.

Geology, Faculty of Education, Tohoku University, for his kind supervision. Thanks are due to Mr. Kin-ichi Nakaya for his assistance in the field.

Family Pectinidae

Subfamily Pectininae

Genus *Gloripallium* Iredale, 1939

Gloripallium crassivenium (Yokoyama), 1929

Plate 32, Figures 1a-c, 2a-b, 3a-d.

1929. *Pecten* (*Chlamys*) *crassivenius* Yokoyama, *Imp. Geol. Surv. Japan, Rep. No. 104*, p. 6, pl. 6, fig. 1.

1935. *Chlamys crassivenia* (Yokoyama), Otuka, *Bull. Earthq. Res. Inst., Vol. 13, Pt. 4*, p. 886, pl. 55, figs. 137, 139, 141.

1940. *Pecten* (*Chlamys*) *crassivenius* Yokoyama, Nomura, *Sci. Rep., Tohoku Imp. Univ., Ser. 2, Vol. 21, No. 1*, pl. 2, figs. 13a-b.

1940. *Pecten* (*Swiftopecten*) *nanakitaensis* Nakamura, *Jour. Geol. Soc. Japan, Vol. 47, No. 561*, p. 37, text-fig. 1.

1954. *Gloripallium crassivenium* (Yokoyama), Hirayama, *Sci. Rep., Tokyo Kyoiku Daigaku, Sec. C, Vol. 3, No. 18*, p. 52, pl. 3, figs. 11, 12, 18.

M. Yokoyama's original description is quoted below for the sake of persons to whom the original work is inaccessible.

"Shell medium-sized, thick, compressed, orbicular, slightly higher than long, subequilateral, radiately ribbed. Ribs nine, strong, rounded, trichotomous with the middle branch somewhat larger than the lateral ones, coarsely scaly, with interspaces broader and filled with four or five equal or unequal scaly riblets. Inner border crenate. Height 64 mm. Length 62 mm. Depth 12.3 mm."

The specimens collected by the writer with the assistance of K. Nakaya, take the following description.

Shell moderate in size, higher than long, moderately thick, compressed, nearly equivalve, inequilateral, posterior side longer than anterior; convexity more or less asymmetrical, maximum depth situated posteriorly in right valve and anteriorly in left; valves radiately ribbed, and forming an angle of about 90° at apex.

Right valve with nine to ten, elevated, strongly imbricated radial ribs and a few imbricated intercalary threads between them; radial ribs broader than their interspaces which are smooth or ornamented by obtuse network, divided into conspicuously imbricated; several parts by shallow longitudinal furrows which are much narrower than the divided threads and rather smooth-bottomed; divided radial threads on the central part of radial ribs usually broader than the lateral ones; radial ribs near submargins narrower and less elevated than those of central part of disc, and may divided into two or remain undivided; primary division of radial ribs first appears near the beak with or without scales, and further division, intercalation and imbrication gradually increases towards the ventral margin; scales nearly disc-like in shape, rather flat, becoming closely packed and imbricate or overlap towards the ventral margin, inclined apically; intercalary threads usually two or three in number, first appears at about half of disc length, subequal to lateral divided threads; anterior auricle triangular in form and larger than posterior one, sculptured with a few imbricated radial threads and concentric lines, and furnished with very shallow byssal notch, rather narrow

byssal area, but in younger shell with somewhat deeper byssal notch than in adult specimens; posterior auricle truncated behind at about right angle and slightly concave downwards, and sculptured with several imbricated radial threads and concentric lines; hinge with rather distinct cardinal crura, ill-developed ctenolium, and rather wide and shallow resilial pit provided with faint lateral ridges. Left valve with sculpture almost similar to the right, though radial ribs usually divided into three or rarely several parts by longitudinal furrows, the middle one in the case of trifurcation being larger than lateral ones; interspaces between radial ribs somewhat narrower than or nearly equal to the radial ribs, furnished with three to five equal or subequal imbricated intercalary threads. Internal surface folded, and with fine serration at ventral margin.

Dimensions in mm.:—

Valve	Right	Right	Right	Right**	Left	Left	Left	Left**
Height	83	81	77	36.5	84	81	76	36.5
Length	73	74	66	33.5	75	74	67	33.5
LAS*	32	32	28	15	32	32	28	15
LPS*	41	42	38	18.5	43	42	39	18.5
Hinge-length	35	35	30	16.5	34	35	33	16.5
Depth	7	7	6.5	5.5	7	7.5	7	5.7
Apical angle	90°	90°	85°	90°	90°	90°	90°	90°

* LAS is the anterior diameter of the valve that lies in front of the plane passing perpendicular to the hinge at the beak, and the posterior diameter of that of LPS. LAS=abbreviation for length of anterior side. LPS=abbreviation for length of posterior side. The methods of measurement are according to C. B. DAVENPORT (1903).

** Specimens from Izumo (Shimane Prefecture), and preserved in the collection of the Institute of Geology and Paleontology, Tohoku University.

Type Locality, Formation and Geological Age:—Iwaya, Nanao City, Ishikawa Prefecture. Nanao formation. Early Miocene.

Described Specimens:—Upstream of the Iwasawa, Waga-machi, Waga-gun, Iwate Prefecture. Very fine-grained sandstone of the Suzukamo formation (Miocene). DGS, Reg. Nos. 3401 and 3402.

Remarks:—This species is characterized by the compressed, posteriorly contorted shell which is higher than long, nine to ten elevated radial ribs which are divided into several, conspicuously imbricated radial threads by shallow longitudinal furrows, a few imbricated intercalary threads, triangular anterior auricle furnished with a shallow byssal notch, ill-developed ctenolium, and fine marginal serration on internal surface. Very rarely the radial ribs consist of a set of two radial ribs and the interspace between them is very shallow and narrow, and with no intercalary thread.

As already described, the imbrication of the scales on the radial ribs is so characteristic and so conspicuous that the external casts of this species sometimes show the characteristic features. However, sometimes such features are

not observed, and when only external moulds are faintly preserved or obliterated, they may be misjudged for a different species. Careful observations of shell form, arrangements of radial ribs and features of auricles even in mould specimens serve to distinguish this species from its related forms.

This species has hitherto been reported under generic names of *Pecten* and *Chlamys*, but recently K. Hirayama (1954) referred it to the genus *Gloripallium* with some doubt. The writer also considers that this species may be referred with some doubt to the genus *Gloripallium*. However, the generic characters of *Gloripallium* differ from the present species in having the cardinal crura consisting of two, very strong, diverging, very rugose ribs.

Comparison and Affinity:—Pecten (Swiftopecten) nanakitaensis was described by M. Nakamura (1940) based upon a cast of a single right valve from the Miocene Nanakita formation at Dôniwayama, Izumi-machi, Miyagi-gun, Miyagi Prefecture and was distinguished from the present species by the smaller shell, fewer number of radial ribs and different surface sculpture. However, by the re-examination of the type specimen (IGPS, coll. cat. no. 61334) preserved in the collection of the Institute of Geology and Paleontology, Tohoku University, the writer considers that *nanakitaensis* is a synonym of *crassivenium*.

When this species is badly waterworn, the characteristic surface sculpture becomes obliterated, so that it sometimes resembles "*Patinopecten kagamianus* (Yokoyama)" having a less number of radial ribs. However, it differs from "*kagamianus*" by the posteriorly contorted shell, possession of several intercalary threads, and characteristics of the auricles in the right valve, and in the left valve by the radial ribs which are nearly equal to the interspaces in breadth.

Occurrence:—The specimens collected from the very fine-grained sandstone of the Suzukamo formation usually occur with intact valves and they are arranged parallel with the bedding plane. In the case of intact valves, the right is always the lower and the left the upper, therefore, it is probable that they were buried *in situ*. The molluscan shells found in the association belong to such genera as *Solemya*, *Limatula*, *Lucinoma*, *Macoma* etc., and the majority of them also occur with intact valves. In general, the present species is common in fine-grained sandstone or sandy siltstone, but rather rare in coarse-grained sandstone or conglomerate. From such

Text-fig. Map showing the distribution of *Gloripallium crassivenium* (Yokoyama) in Japan.

1. Suzukamo. 2. Maekawa. 3. Kotsunagi. 4. Nanamagari. 5. Aoso and Nanakita. 6. Tsunaki. 7. Urushikubo. 8. Kobana. 9. Kutegawa. 10. Nanao. 11. Iori. 12. Uncertain in Shimane Prefecture.

facts, it may be inferred that *crassivenium* probably preferred a sea bottom consisting of fine-grained sediments rather than of coarse ones and in regions not influenced by strong currents.

Crassivenium is now known to occur from such formations as the Nanao and Kutegawa of Ishikawa Prefecture, the Iori of Toyama, the Kobana of Tochigi, the Urushikubo of Fukushima, the Tsunaki, Aoso, Nanakita and Nanamagari of Miyagi, the Maekawa and Suzukamo of Iwate, and the Kotsunagi of Akita Prefectures. It is also recorded from Shimane Prefecture but the exact locality and formation remain unknown (text-fig.). The geological age of the formations which have yielded the present species may all be referred to the Miocene, and the writer considers that the geological range of *crassivenium* is restricted to the early Miocene in a twofold division.

Gloripallium izurensis Masuda, n. sp.

Plate 32, Figures 4, 5a-b, 6.

Shell rather small in size, higher than long, rather thin, nearly equivalve, moderately inflated, inequilateral, anterior side a little less than posterior; valves radiately ribbed, and forming an angle of about 85° at apex.

Right valve with six, elevated radial ribs, in which two near submargins are narrower and less elevated than those of central part of disc, a few intercalary threads between the radial ribs, and fine network; radial ribs in the central part of disc conspicuously elevated, round-topped, broader than their interspaces, and divided into several parts with no scales by shallow longitudinal furrows near the beak; divided radial threads on the backs of radial ribs tend to become obsolete downwards, but numerous radial threads appear near the ventral margin; intercalary threads four or a little more in number, appear near the ventral margin and subequal to the divided threads in strength; anterior auricle much larger and longer than the posterior, sculptured with several radial threads and concentric lines, and furnished with deep byssal notch and rather wide byssal area; posterior auricle truncated behind at about right angle, slightly concave downwards, and sculptured like the anterior; hinge with rather distinct cardinal crura, ctenolium, rather wide and shallow resilial pit provided with lateral ridges. Left valve with five, elevated, finely imbricated radial ribs, several intercalary threads between the radial ribs, and fine network; radial ribs narrower than their interspaces, divided into finely imbricated, several parts by shallow longitudinal furrows; primary division of radial ribs appears near the beak with fine scales, and further intercalation and imbrication gradually increase towards the ventral margin; several intercalary threads appear near the ventral margin; anterior auricle triangular in form and much larger than the posterior, sculptured with a few radial threads and concentric lines; posterior auricle sculptured like the anterior. Internal surface distinctly folded corresponding to the external sculpture, and with fine serration at ventral margin.

Type Locality, Formation and Geological Age:—Izura, Ôtsu-machi, Kita-Ibaraki City, Ibaraki Prefecture. Lat. 36°49′06″ N., Long. 140°48′02″ E. Kokozura formation. Miocene.

Depository:—Holotype, DGS, Reg. No. 3577. Paratype, DGS, Reg. No. 3578.

Remarks:—The right valve of this species is characterized by its rather

Valve	Right*	Right	Right	Left	Left**
Height	29	ca. 45	13.5	35	53
Length	26	39.5	12.5	33	47
LAS	12	18	6.5	17.5	22
LPS	14	21.5	7	15.5	25
Hinge-length	13	17.5	8.5	15.5	—
Depth	5.5	9	2	6.5	9
Apical angle	85°	85°	85°	90°	85°

Dimentions in mm: * Holotype. ** Specimen from the Suenomatsuyama formation at Jyûmonji, Tômae-mura, Ninohe-gun, Iwate Prefecture.

small, moderately inflated shell which is provided with five to six, conspicuously elevated radial ribs which are divided into several parts by shallow longitudinal furrows near the beak, and by the divided threads which tend to become obsolete towards the ventral margin and the numerous divided threads near the ventral margin; left valve by five to six, elevated radial ribs which are divided into several parts with finely imbricated scales.

Comparison and Affinity:—*Gloripallium crassivenium* (Yokoyama), described in earlier pages, is closely related to *izurensis*, but the latter distinguishable from *crassivenium* by the small shell, much elevated and less number of radial ribs with no scales, deep byssal notch in the right valve, and in the left valve by the less number of radial ribs which are divided into several parts furnished with finely imbricated scales.

Occurrence:—Kokozura formation in Ibaraki Prefecture; Ajiri formation in Miyagi Prefecture and Suenomatsuyama formation in Iwate Prefecture; Early to Late Miocene in age.

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Explanation of Plate 32

Figs. 1a-c. *Gloripallium crassivenium* (Yokoyama). a, Right valve, ×1. b, A part of the outer surface of Fig. 1a, ×ca. 1.7. c, Hinge area of Fig. 1a, ×1. DGS, Reg. No. 3401. Loc. Upstream of Iwasawa, Waga-machi, Waga-gun, Iwate Prefecture.

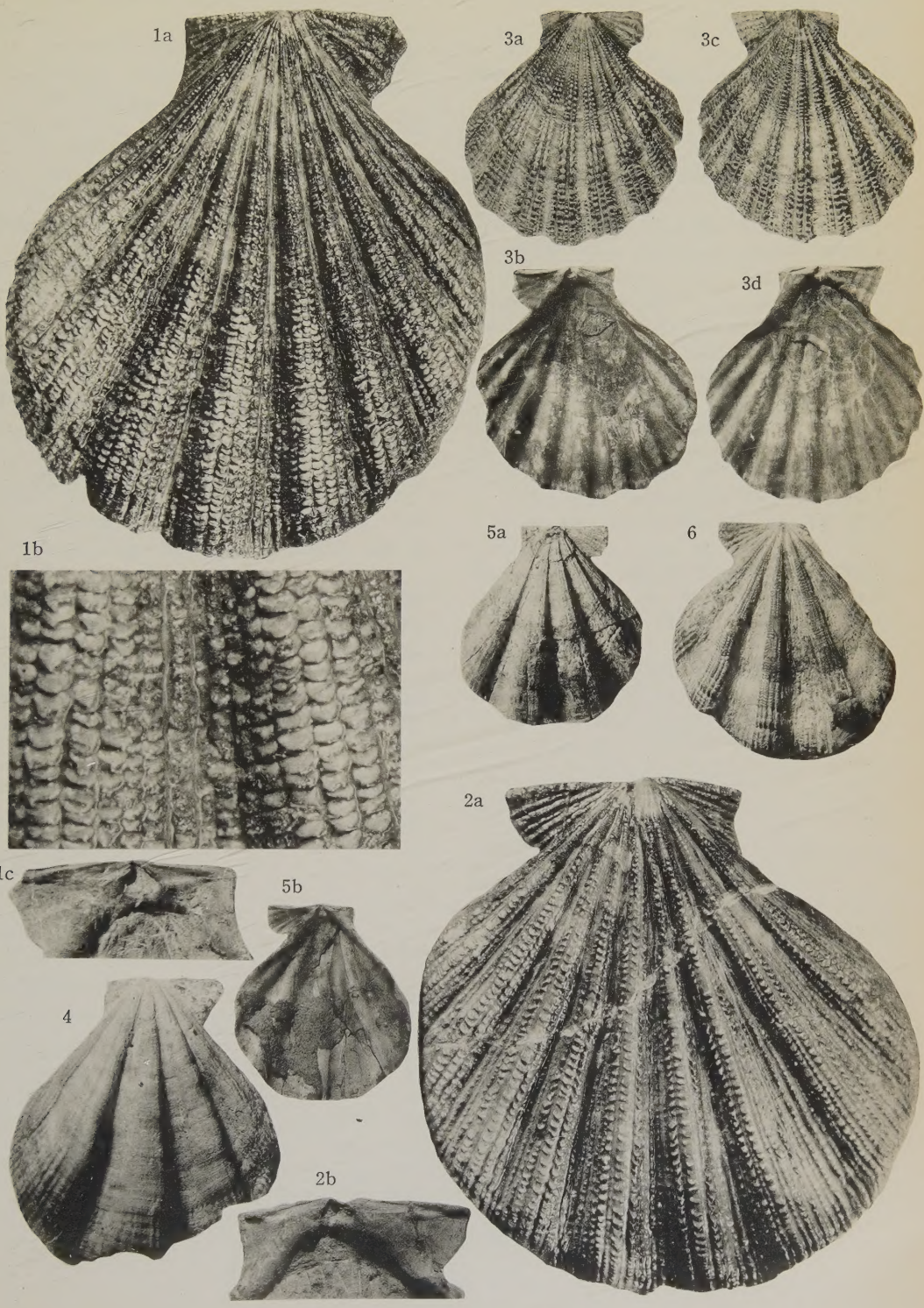
Figs. 2a-b. *Gloripallium crassivenium* (Yokoyama). a, Left valve, ×1. b, Hinge area of Fig. 2a, ×1. DGS, Reg. No. 3402. Loc. Same as above.

Figs. 3a-d. *Gloripallium crassivenium* (Yokoyama). a, Right valve, ×1. b, Internal view of Fig. 3a, ×1. c, Left valve, ×1. d, Internal view of Fig. 3c, ×1. IGPS, coll. cat. no. 72484. Loc. Shimane Prefecture (locality unknown).

Fig. 4. *Gloripallium izurensis* Masuda, n. sp. Paratype, DGS, Reg. No. 3578. Loc. Izura, Otsu-machi, Kita-Ibaraki City, Ibaraki Prefecture.

Figs. 5a-b. *Gloripallium izurensis* Masuda, n. sp. Holotype, DGS, Reg. No. 3577. a, Right valve, ×1. b, Internal view of Fig. 5a. Loc. Same as above.

Fig. 6. *Gloripallium izurensis* Masuda, n. sp. Paratype, DGS, Reg. No. 3578. Left valve, ×1. Loc. Same as above.



K. Masuda Photo.

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SHORT NOTES

2. Once again on a rare species *Triceratium simplex* J. BRUN*

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I stated reasons for the determination of a rare species *Triceratium simplex* J. BRUN on Trans. Proc. Palaeont. Soc. Japan, N. S., No. 27, pp. 107–109, pl. 18, Sept. 30, 1957.

In the end of December, K. NAKASEKO who is the instructor of the Geological Institute, the Osaka University called at our laboratory. So I had an opportunity to exchange our views on the samples which were described by me as belonging to a rare species *Triceratium simplex* J. BRUN.

Some samples which I have used in this paper are very silicified and their minute structures have suffered utter change beyond recognition. They are also found in the relatively old period from the upper Miocene to the lower Pliocene in the Neogene Tertiary of Japan.

The main point in our discussions is that outlines of the rare species bear a remarkable resemblance to some ones of the *Radiolaria*. He showed me some samples of recent species of the *Radiolaria*, and explained their outlines and structures by means of a microscope. Each sample is very fresh, and their minute structures of skeletons still remain as they were. Especially, the spongy tissue of their skeletons is characteristic, and such tissue can not be found in any structure of the Diatomaceae.

As figures 1–6 in pl. 18 of my paper show, these specimens can easily arrange themselves one after another according to their forms. But on NAKASEKO's opinion, these specimens as *Radiolaria* are grouped into two genera; namely, figures 1–4 belong to *Dictyocoryne*, figures 5–6 to *Rhopalodictyum*.

The ground of naming the above fossils as *Triceratium simplex* depends entirely on the figure and description of J. BRUN and J. TEMPÈRE (1889). If their works at that time are far from being perfect, my naming these fossils as a species of the *Diatomaceae* does not seen fit in logical conclusion. On such a consideration, I remove these fossils from a species of the *Diatomaceae*, and according to NAKASEKO's opinion, propose to suggest these as some genera of the *Radiolaria*. In this case, as I have no up-to-date knowledge of *Radiolaria*, I am indebted to NAKASEKO for the classification and nomenclature of of these specimens.

* Received May 12, 1958.

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 31, pp. 231-236, pl. 33, Aug. 15, 1958.

342. ON *LUCINOMA AOKII*, A NEW PLEISTOCENE LAMELLIBRANCH FROM CHIBA PREFECTURE, JAPAN*

— Notes of Japanese Lucinid Molluscs Part 3 —

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Tokyo University of Education

千葉県産更新世二枚貝の新種 *Lucinoma aokii* について： 筆者は日本産 *Lucina* 科貝化石を研究するうちに，千葉県の更新統笠森層から *Lucinoma* 属の著しく大型の標本が産出することを知った。同標本は従来知られている種 *acutilineata, spectabilis* などに類似するが，比較検討の結果差違が認められるので *Lucinoma aokii* の新種名をあたえた。異常に大型な本種について，その古生物学的および層位学的意義を簡単に付加した。 平山勝美

Introduction

During his paleontological studies on lucinid molluscs from Japan, the writer found an interesting specimen which was collected by himself from the sandy siltstone of the Pleistocene Kasamori formation, Bôsô Peninsula, Chiba Prefecture. This interesting lucinid is characterized by its unusually large size, and as a result of the study, a new name is proposed in this paper.

This paper also gives a brief survey of the statistical studies on the relative growth of the present one and its allied species. The result of this investigation suggests that the growth of this gigantic species represents a different type. Although data are insufficient with regard to this problem of extraordinarily large size, we may assume the possibility that a change in their environmental condition or the physiological acceleration of the animal individuals are related with the production of the abnormal forms. The tentative conclusion regarding the great growth of *Lucinoma aokii* is the very good environmental adaptation as well as the increase of the growth element of the animal as suggested by the investigation of relative growth.

Here particular notice attention should be given to another gigantic lucinid known as *Lucinoma spectabilis*, a shell which has been reported only from the Pliocene Koshiba formation of the Miura Peninsula, Kanagawa Prefecture by M. Yokoyama. It may be added that together with *L. aokii*, so far as known at present, it is restricted in stratigraphical range from the Upper Pliocene? to the Lower Pleistocene. The specimens of *L. acutilineata* and *L. annulata* have not been found from these deposits, at least not from the Kasamori and or a part of the Koshiba formations in the Southern Kwanto district, although they are not rare in Japan, fossil or Recent.

* Received Oct. 25, 1957; read June 18, 1955.

Many species of *Lucinoma* have been described from the Miocene rocks of Japan; these have appeared under the names of *izirii, katayosensis, hanezawaensis, otukai, shinokii, gracilistriata, hannibali, columbiana* and so called *acutilineata* and *annulata*. These mentioned species are each characterized by specific features but some may be closely related with one another. On the contrary, from the upper Pleistocene and Recent seas of Japan only "*acutilineata*" and "*annulata*" have been found.

From the many species with different geological ranges and different sizes and shapes may be notworthy that the significance of the phenomenon has relation with the consideration of the phylogeny of the genus *Lucinoma*. However, the possibility is reserved as a future project owing to that there still remains much to be studied.

Before going to the description, the writer wishes to offer his thanks to Professor Kotora Hatai for his valuable advice and reading the manuscript.

Description of Species

Family Lucinidae

Genus *Lucinoma* Dall, 1901

Lucinoma aokii Hirayama, n. sp.

Plate 33, Figures 1-6.

Description:—Shell very large, test thick, strongly convex, equivalve, inequilateral; nearly circular in outline, length being slightly greater than the height. Beaks small, more or less prominent, situated anterior to middle. Antero-dorsal slope very short, steeply concave, forming with anterior border a remarkable angulation. Anterior margin bluntly angulated, antero-ventral nearly straight, passing into well curved ventral and posterior margins. Postero-dorsal slope long, regularly and roundly rounded toward posterior margin. Maximum convexity of the shell slightly dorsal to middle of the shell height. Very indistinct bluntly depressed area on both sides of valve presents oblique area at postero-ventral corner. Shell surface of immature and middle stages sculptured by periodic and concentric lamellae which are separated by interspaces wider and variable in width. But the sculpture of adult or marginal region represented by narrow, fine and irregularly raised, numerous concentric striae. Lunule small for size of shell, elongated-ovate in shape. Sulcus deeply depressed, provided with very fine oblique lines; escutcheon narrow lanceolate, long distinctly marginated. Both extending throughout almost whole length of antero- and postero-dorsal margins. Inner surface of the shell porcellaneous, somewhat lucid, smooth, but becomes rough and pinples at the margin. Anterior muscular impression long, parallel to antero-ventral margin and posterior muscular impression nearly ovate, large in size; both distinctly depressed. A blunt ridge extends obliquely from postero-ventral border toward umbo.

Dimensions in mm.:—Length 101, height 95, thickness 56, length of lunule 24.1, width of lunule 8.4, length of escutcheon 53.5 and width of escutcheon 6.2; thickness of shell 4.5–6.0. Holotype specimen. Most of the paratype specimens are more or less fractured. Therefore, either length or height and the other dimensions are not measured. However, the specimens from Nagahata is represented by inner mould and its dimensions are:—

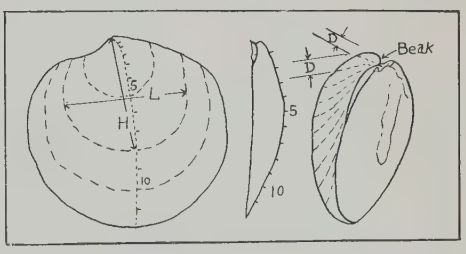
	Length	Height	Thickness
1.	76	ca. 69	41
2.	ca. 69	64	32

Comparisons:—This new species bears some resemblance with *Lucinoma spectabilis* (Yokoyama), *L. acutilineata* (Conrad) and *L. annulata* (Reeve), but may be distinguished from them as to be mentioned. This species may be distinguished from *spectabilis* which was recorded from the Pliocene Koshiba formation in the Miura Peninsula, Kanagawa Prefecture, by the different type of sculpture of the shell surface, more rounded ventral, posterior and postero-dorsal margins and more sharp angle between antero-dorsal and anterior borders; from *acutilineata* and *annulata*, which ranges from the Miocene rocks up to the Recent seas of Japan, by its larger size and the characteristics of the mentioned features upon which it was established. Unfortunately, comparative investigation with Yokoyama's original specimen of *L. spectabilis* has been left untouched owing to causalties during the World War II and the topotype specimen in the writer's collection is not perfect. Therefore, comparison was made upon Yokoyama's original description and figures. This species resembles *Miltha* (*Lucinoma*) *annulata* (Reeve), reported by T. Fujita (1929, p. 62, pl. 3, fig. 4) from Tateyama Bay, Chiba Prefecture. He stated that this shell attains a very large size at maturity and may be a synonym of Yokoyama's *spectabilis*. However, the writer should like to separate them for the reasons already mentioned. This species is also related to *Lucinoma heroicus* Dall an East American species in its general outline and sculpture in the immature and middle stages of the shell, but the aspects in the adult stage tend to a more rounded outline and finer sculpture.

Remarks:—The specific name is dedicated to Mr. Shigeru Aoki of our Institute for his kind suggestions with regard to the writer's study of Lucinid molluscs.

Comparative investigations were made on specimens of *Lucinoma acutilineata*, *L. annulata* and this new species. The specimens of *acutilineata* and *annulata* comprises the writer's collection from various localities and horizons of the Japanese Tertiary and Quaternary deposits. Besides, some specimens from the Pleistocene deposits of California, North America, were used for comparison with the Japanese materials.

The investigation made on the left valve included the length, height and depth of the shell at each of the stages in the process of growth. As shown in Text-figure 1, the recognized twelve growth stages were defined by the concentric striae which were plotted at voluntary points along the shell height, and the measurements were determined along the border line of the defined stage. These dimensions are carefully measured with callipers, and the values are counted to 1/20 mm.



Text-fig. 1. Method of Measurement.

The results of calculation and measurements are shown in the following Table 1, and graphically in Text-figure 2.

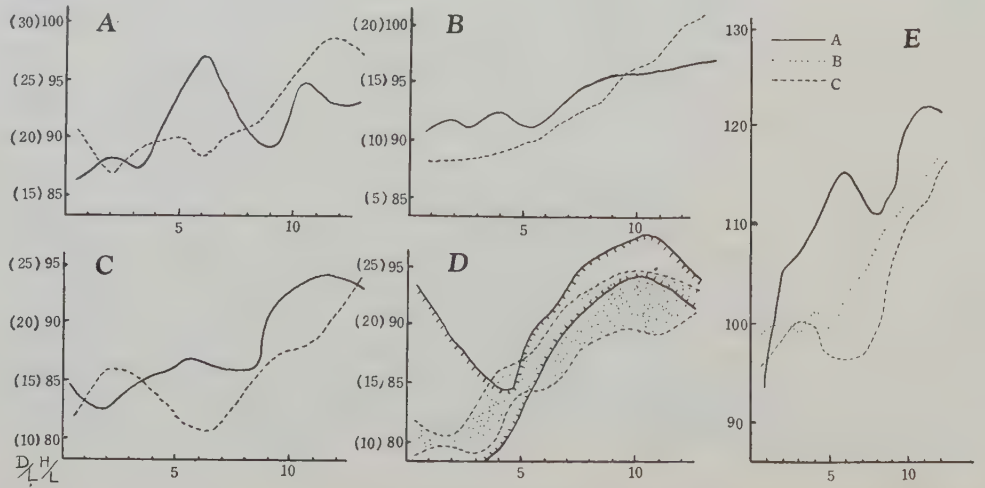
So far as these observations are concerned, it may be inferred that the growth of the present materials shows different trends through their stages.

Table 1. Values of L., H., D. and H/L, D/L in 12 growth stages.

Growth stages		*aokii* (left valve, holotype)					*acutilineata**					*annulata**					So-called "*acutilineata*"**	
		L.	H.	D.	H/L	D/L	L.	H.	D.	H/L	D/L	L.	H.	D.	H/L	D/L	H/L	D/L
Adult—Immature	1	11.5	10.0	2.3	86.94	20.00	8.0	6.7	1.0	83.75	12.50	8.6	7.8	0.7	90.69	9.14	70.90-93.54	8.18-10.51
	2	18.1	16.0	3.1	88.39	17.10	10.9	9.0	1.7	82.57	15.59	10.9	10.0	0.9	91.74	8.25	73.51-90.00	9.09- 9.93
	3	26.3	23.1	4.9	87.82	18.63	14.1	11.9	2.2	84.39	15.60	13.2	12.0	1.1	90.91	8.33	70.14-87.58	8.27-14.28
	4	34.4	31.0	6.8	90.11	19.76	18.1	15.4	2.7	85.11	14.92	16.1	14.9	1.5	92.54	9.31	77.50-82.95	10.58-16.66
	5	42.5	39.8	8.6	93.63	20.23	23.4	20.0	2.9	85.47	12.59	20.1	18.1	1.9	90.48	9.45	87.31-89.57	13.26-16.79
	6	49.1	47.5	9.3	96.74	18.94	29.2	25.3	3.2	86.64	10.96	23.5	21.4	2.6	91.51	11.06	88.47-90.04	14.45-20.68
	7	64.5	60.0	13.1	93.20	20.31	36.2	31.2	4.2	86.19	11.56	28.1	26.2	3.3	93.24	11.74	90.91-93.17	16.07-21.31
	8	74.2	67.0	15.4	90.29	20.75	42.1	35.8	6.1	85.03	14.49	31.9	30.1	4.4	94.35	13.72	91.63-95.52	17.89-22.38
	9	82.0	73.0	20.0	89.03	24.31	43.7	39.6	7.5	90.62	17.16	35.4	33.9	5.4	95.76	15.26	94.73-96.03	17.99-23.45
	10	88.8	84.2	22.8	94.83	25.66	46.5	43.1	8.1	92.69	17.42	38.9	37.1	6.2	95.86	15.93	94.44-96.56	17.63-23.67
	11	95.0	88.9	27.0	93.58	28.42	48.2	45.1	9.0	93.57	18.66	42.8	41.2	7.8	96.25	18.22	94.12-96.93	18.27-24.04
	12	101.0	94.5	28.5	93.56	28.31	50.5	47.1	11.1	93.26	21.98	45.6	44.2	9.2	96.93	20.19	92.08-94.97	19.55-23.31

* Specimens from the Pleistocene deposits of California, USA, that are considered to be typical forms.

** Japanese Tertiary and Recent specimens of the so called "*acutilineata*". The maximum and minimum values of H/L and D/L only are shown.



Text-fig. 2: Graphic Representation of the Results: Relationship of H/L and D/L (A-D) and values of H+D/L (E) in 12 growth stages.

A; *Lucinoma aokii*
(——: H/L, ……: D/L)
B; *L. acutilineata* („)
C; *L. annulata* („)
D; So-called *L. acutilineata* („)
E; A:—*L. aokii*, B:—*L. acutilineata*, C:—*L. annulata*.

Table 2: Values of $\frac{H+D}{L}$

	aokii	*acutilineata*	*annulata*
1	93.49	98.93	96.25
2	105.53	100.00	98.16
3	106.46	99.24	100.00
4	109.98	101.86	100.00
5	113.88	99.50	97.86
6	115.68	102.12	97.60
7	113.33	104.98	97.79
8	111.05	108.15	99.52
9	113.41	111.01	107.78
10	120.49	113.31	110.17
11	122.00	114.48	112.24
12	121.78	117.10	115.25

That is to say, the growth of *Lucinoma aokii* is distinctly faster than the others and also becomes separate as an abnormal form since the immature stage. The cause and significance of this problem are explained in the compatibility or change of their environmental condition or the physiological acceleration of the animal. However, before conclusive remarks are given there remains more to be investigated.

Localities and Geological Horizons:—This new species was collected from the Pleistocene Kasamori formation exposed near Kasamori (Type locality), Uchihata, Nagahata and Kuriyama, Chiba Prefecture. The Kasamori formation which yielded the present specimens is a name first proposed by K. Sakakura (1935) as the second division from the lower of his Tsurumai group, and to this unit also belongs the Tôgane silt Beds and Yôanji silt and sand Beds of Oinomikado and Ikebe (1934). The above mentioned localities in further details are given in the following list.

(1) Road-side cliff at the entrance of the tunnel, a little southwest of Kasamori village, Minakami-mura, Chôsei-gun, Chiba Prefecture. Lat. 35°23′30″N, Long. 140°11′20″E, topographic map in the scale of 1/50,000, "Anegasaki". Type locality. Common. Reg. No. 10392, Holotype; Reg. No. 10393, Paratype. Lower part of the Kasamori formation, Pleistocene.

(2) Road-side cliff at Uchihata, Nagaemura, Chôsei-gun, Chiba Prefecture. Lat. 35°27′25″N, Long. 140°15′15″E, "Anegasaki". Common. Reg. No. 10394. Lower part of the Kasamori formation, Pleistocene.

(3) Path-side cliff at Nagahata, Oami-Shirasato-machi, Sanbu-gun, Chiba Prefecture. Lat. 35°29′50″N, Long. 140°18′25″E, "Mobara". Few. Reg. No. 10395. Middle part of the Kasamori formation Pleistocene. The fossils from this locality are represented by moulds only, and the specimens were collected by Miss Yasuko Asahina, a former student of our Institute.

(4) Path-side cutting of the pass between Kuriyama and Maebara, Oami-Shirasato-machi, Sanbu-gun, Chiba Prefecture. Lat. 35°32′5″N, Long. 140°19′20″E, "Tôgane". Few. Reg. No. 10396. Middle part of the Kasamori formation, Pleistocene.

Associated Faunule and Ecology:—The molluscs occurring in association in the above mentioned localities are:—

Portlandia lischkei (Smith)
Portlandia japonica (Smith)
Yoldia naganumana Yokoyawa
Nuculana yokoyamai Kuroda
Neilonella coix Habe
Limopsis uwadokoi Oyama
Conchocele bisecta (Conrad)
Callithaca adamsii (Reeve)
Nemocardium samaragae (Makiyama)
Macoma "calcarea (Gmelin)"
Raeta rostralis (Deshayes)
Raeta pulchella Adams and Reeve
Dentalium yokoyamai Makiyama
Turritella nipponica Yokoyama
Neptunea authritica Reeve
Nassarius magnifica Lischke

Gemmulofusus makiyamai Otuka
Fulgoraria prevostianus (Crosse)
Makiyamaia coreanica (Adams and Reeve)
Japelion hirasei (Pilsbry)

This new species occurs in association with the above mentioned molluscs, smaller foraminifera and brachiopoda, all of which suggest an environment of the littoral and neritic zones and seems to have been under the influence of cold temparate waters. The predominating rocks of this deposits consist of massive sandy siltstone, siltstone and very fine-grained sandstone with intercalated thin pumice and tuff layers, besides, there is often developed an alternation of sandstone and siltstone in the top of the formation and in the western district of its distribution. From the facies of alternating layers of sandstone and siltstone it may probably suggest an environment of more or less shallower deposition than the part of the massive sediments, and from this part no fossils were collected. However, the present fossil is restricted in occurrence to the massive sandy siltstone, with still intact valves in upright position or its natural living position. The species was collected mainly from the western area of distribution of and from the lower or middle parts of the Kasamori formation. The ecologic fact to be mentioned is that this species lived in environment influenced with cold temperate and somewhat deep waters.

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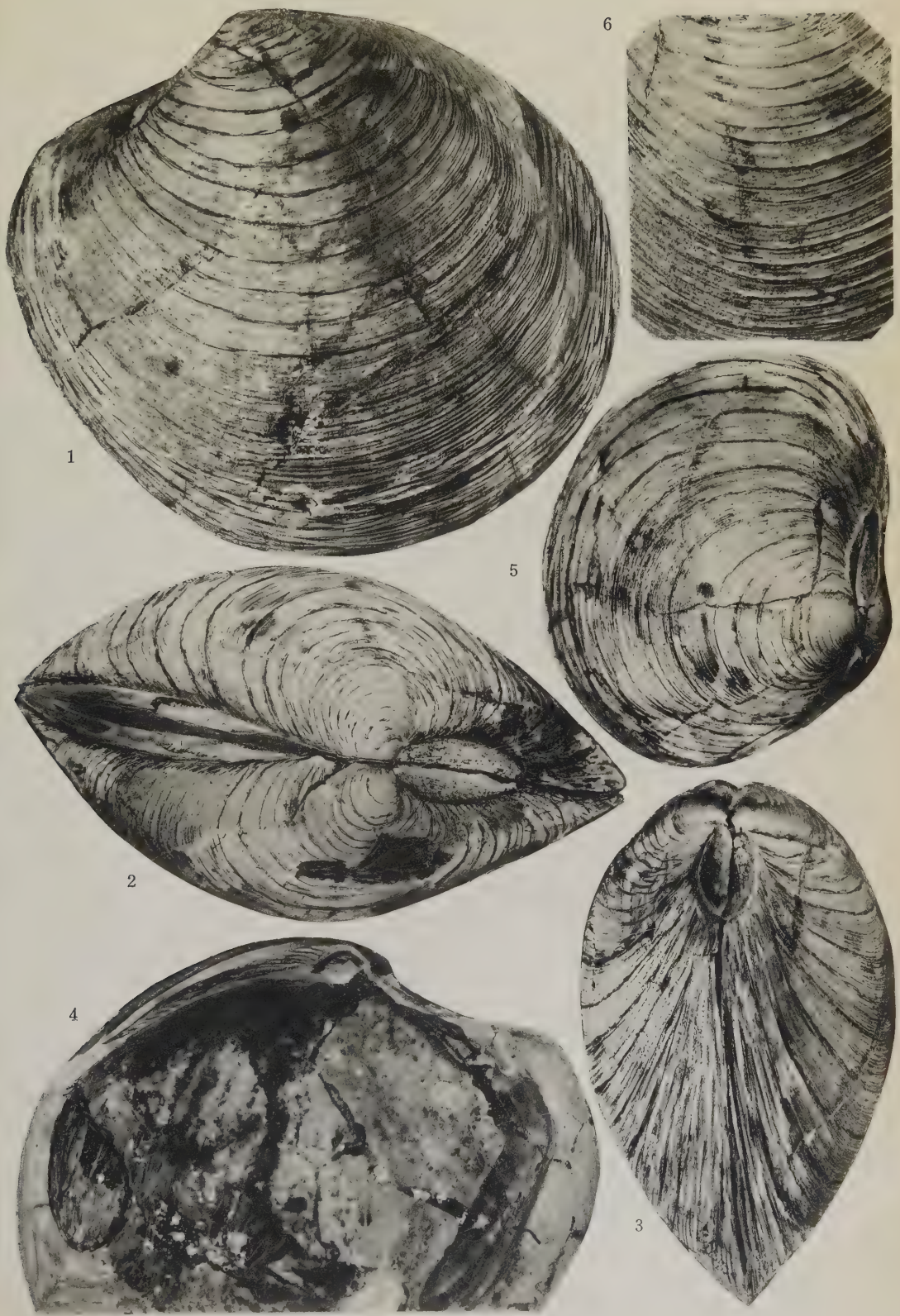
Explanation of Plate 33

Figs. 1-6. *Lucinoma aokii* Hirayama, n. sp. ..... p. 231
Fig. 1: Left side view of holotype specimen (×1), Fig. 2: Dorsal view of holotype specimen (×1), Fig. 3: Anterior view of holotype specimen (×1), Fig. 4: Interior view of holotype specimen (×1), Fig. 5: Apical view of holotype specimen (×$\frac{2}{3}$), Fig. 6: Surface sculpture of the paratype specimen (×$\frac{4}{5}$). Reg. No. 10393. Type locality: Road-side cliff at the entrance of the tunnel, a little southwest of Kasamori village, Minakami-mura, Chôsei-gun, Chiba Prefecture.



K. HIRAYAMA Photo.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 31, pp. 237-242, pls. 34, 35, Aug. 15, 1958

343. ELECTRON-MICROSCOPIC FINE STRUCTURE OF FOSSIL DIATOMS. V*

Observation on some diatoms found in the "Celatoms"

HARUO OKUNO

Kyoto University of Textile Fibers

化石珪藻の電子顕微鏡的微細構造. V：米国 Eagle-Picher 珪藻土会社 P. M. Rapier 氏より送付を受けたネバダ州産珪藻土原土及び精製珪藻土（中新世）のなかに見出された化石珪藻数種の微細構造を記した。送付を受けた珪藻土標本は4品で，うち3品については，それぞれの優占種である *Melosira granulata* 及び f. *curvata*, *Mel. distans* の微細構造を記し，いま1つの優占種を持たない標本については，そのなかにやや多く見出された新種 *Tetracyclus Celatom* の微細構造を記した。また4標本中に見出された上記以外の化石珪藻は，それらの種名を一括して記した。 奥野春雄

This study is based upon several samples of the crude and refined "Celatoms[1])" sent me by Mr. P. M. Rapier of the Eagle-Picher Company. The samples were almost purely composed of fossil diatoms of fresh water origin. The excellent properties of the Celatoms —light weight, purity, porosity, amorphous structure, high fusion point, etc. —make them suitable for high temperature insulator, filter aid, filler, extender, carrier, admixture, etc. As many of the Celatoms are almost purely composed of dominant diatoms, respectively *Melosira granulata* (OD-100, crude, immediately under the next stratum of f. *curvata*), f. *curvata* (OD-100, crude, upper stratum), and *Mel. distans* var. *lirata* (refined, MN-35), it is obvious that the versatile uses of Celatoms depend almost entirely upon these dominant diatoms. And in this paper, mainly the submicroscopic fine structures of these dominant diatoms are treated. Owing to their scanty occurrence, the companion fossil diatoms—even noticeable from the palaeontological stand point—are rather inconsequential in their usefulness for industrial application. And in this paper, the companions, except for some new and noticeable species are only listed by their names.

I wish to express my thanks to Mr. P. M. Rapier, Processing Engineer of the Eagle-Picher Company, who kindly sent me samples with descriptions of locality, geological age, etc.

Description of Species

Melosira granulata (Ehrenberg) Ralfs

Plate 34, Figures 1a-d.

Melosira granulata (Ehrenberg) Ralfs, Okuno, 1954, *Trans. Proc. Palaeont. Soc. Japan, N.S., No. 14*, p. 143, pl. 17, figs. 1a, b.

* Received Nov. 22, 1957; read September 28, 1957.

This research was aided by a Grant in Aid for Scientific Research from the Ministry of Education. (No. 408098)

1) Commercial name of refined diatomite produced by the Eagle-Picher Company, U. S. A.

In the present diatomite, the filamentous colonies are almost completely broken into solitary valves or frustules. Valves about 7–20μ in height. Frustule pores on the mantle 5–9 in 10 μ, arranged in longitudinal rows about 7–9 in 10μ. In the present electron microscopy, the fine structure of the frustule pores on the mantle was elucidated. Frustule pores are round to polygonal, probably incompletely locular inwards, being closed outwards and opening freely inwards. The outer closing sieve membrane is netveined (Figs. 1c, d) (sometimes dendriform with anastomosing branches?—Fig. 1b), with 2–6 lunate or kidney-shaped sieve pores (*ksp*) (Pl. 34, Fig. 1c) at the margin and many sieve pores (meshes) of various shapes and sizes in the center. Sometimes the meshes are closed with finely porous secondary sieve membranes (Fig. 1d). The netveins more or less dip in- or outwards, and are supported by 2–6 radially disposed marginal stalks (*st*) ingrown from the border of the outer opening of the loculus. In the present specimen, the degree of destruction of the sieve membranes is rather low, and in many valves sieve membranes were comparatively well preserved. The structure of the sieve membrane is more or less akin to those of *Achnanthes longipes* (Okuno, 1952, p. 6), *Arachnoidiscus ornatus* (Okuno, 1954, p. 238), *Biddulphia pulchella* (Okuno, 1952, p. 48. Helmcke & Krieger, 1954, p. 10), *Cocconeis scutellum* (Okuno, 1950, p. 101), *Didymosphenia fossilis* (Okuno, 1949, p. 99), *Didy. geminata* var. *curvata* (Okuno, 1954, p. 147), *Eucampia balaustium* (Kolbe, 1948, p. 10. Okuno, 1952, p. 350. Helmcke & Krieger, 1954, p. 9), and *Isthmia nervosa* (Desikachary, 1954, p. 616), which are common in having the marginal stalks and netveined or dendriform sieve membranes. I reported another type of sieve membrane in the fossil of *Melosira granulata* from Yamautsuri-mura, Japan. In the Yamautsuri-mura specimens, the sieve membranes were not netveined or dendriform, but membraneous with scattered round sieve pores (Okuno, 1954, p. 143). Thus hitherto, in *Melosira granulata*, two types of sieve membranes—the one netveined or dendriform and the other membraneous—were found by me.

Habitat:—Fresh water, planktonic.

Occurrence:—Dominant in the crude diatomite "Celatom OD-100" from the stratum immediately underlying that of f. *curvata*; contained about 98%. (Specimen, nos. 1719–1720) Near Lovelock, Nevada. Probably Upper Miocene.

Melosira granulata (Ehrenberg) Ralfs forma *curvata* Grunow

Plate 34, Figures 2a, b.

Melosira granulata (Ehrenberg) Ralfs f. *curvata* Grunow, Okuno, 1954, *Trans. Proc. Palaeont. Soc. Japan, N.S., No. 14*, p. 143, pl. 17, figs. 2a, b.

Filaments and frustules more or less curvate. Thick valves about 8–13 μ in diameter and about 7–17 μ in height, thin valves about 3–7μ in diameter and 15–20μ in height, and the latter is closely connected with var. *angustissima* f. *curvata*. Loculi on the mantle about 6–8 in 10μ, arranged in somewhat curved longitudinal lines about 8–10 in 10μ. The sieve membranes netveined as in the foregoing species. Of the same forma from Korea, the presence of such a netveined sieve membrane was already reported by me (Okuno, 1954. p. 143).

Habitat:—Fresh water, planktonic.

Occurrence:—Dominant (about 99%) in the crude diatomite "Celatom OD-100" in the upper stratum. (Specimen, nos. 1724–1725)

Melosira distans (Ehrenberg) Kützing var. *lirata* (Ehrenberg) Bethge

Plate 35, Figures 1a-h.

Melosira distans (Ehrenberg) Kützing var. *lirata* (Ehrenberg) Bethge, Hustedt, 1930, Kieselalg., pt. 1, p. 264, figs. 111a-c.—Mills, 1934, Index, p. 927.—Huber-Pestalozzi and Hustedt, 1942, Diat., pl. 96, figs. 477k-m.

Melosira lyrata A. Schmidt, 1893, Atlas Diat., pl. 181, figs. 69-75.

Melosira lirata (Ehrenberg) Grunow var. *genuina* (Ehrenberg) Grunow, Cleve-Euler, 1951, Diat. Schweden u. Finnland, p. 23, figs. 13a-c.

Chains very short. Frustules cylindric, about 6-25μ in diameter. Discus with scattered frustule pores about 8-10 in 10μ (Figs. 1a, b). Marginal spines minute. Mantle about 5-10μ high, with longitudinal rows of frustule pores about 8-10 in 10μ. Sulcus distinct. In the present specimens, the fine structures of the sieve membrane of the loculi both on the discus and the mantle were fundamentally the same as that of *Mel. granulata*. The outer closed opening of the loculus on the discus is smaller than that on the mantle (compare Figs. 1f and 1g). In the present specimen, the closing sieve membrane of the former is not probably dendriform or netveined, but rather membraneous having irregular thickenings and scattered fine sieve pores, and that of the latter is obviously anastomosed-dendriform as in *Mel. granulata*. The septum of the valve which is seen light-microscopically perforated in the center, was revealed electron optically to be closed with a delicate, finely porous membrane (Fig. 1h). Helmcke and Krieger published electron micrographs of *Mel. distans* in their Diat. Elektr. Bild, pt. 1, pls. 7, 8 (1953). In their pl. 7, fig. lower-right (discus), finely porous sieve membranes with marginal stalk-shaped thickenings were clearly shown.

Habitat:—Fresh water, planktonic.

Occurrence:—Dominant (about 80%) in the refined diatomite "Celatom MN-35"[2]. (Specimen, nos. 1716-1718) In Storey County, 20 miles East of Reno, Nevada, Miocene.

Cymbella cistula (Hemprich) Kirchner

Plate 35, Figures 2a-c.

Cymbella cistula (Hemprich) Kirchner, Cleve, 1894, Synop. Nav. Diat., pt. 1, p. 173.—Hustedt, 1930, Bacill., p. 363, fig. 676a.—Mills, 1933, Index, p. 547.—Okuno, 1952, Atlas Foss. Diat., pl. 16, figs. 1, 9.

Valves slightly arcuate, with centrally gibbous ventral margin and subtruncate ends. Length about 85-180 μ, breadth about 22-33 μ. Central area elliptic to suborbicular, with 3-7 distinct puncta on the ventral side. Striae 6-9 in 10μ, punctate, puncta (frustule pores) in the present specimens coarse, about 10-14 in 10μ. Electron-optically, the frustule pore rectangular, probably incompletely locular, being half-closed outwards by the sieve membrane and opened freely inwards. The outer opening—the sieve pore—usually linear (about 500-600 mμ long, about 100-200mμ broad), often curved or divaricated as in *Cym. australica* and *Cym. tumida* (cf. Okuno, 1956, *Trans. Proc. Palaeont. Soc. Japan, N.S., No. 21*, p. 136-137).

Habitat:—Fresh water, littoral.

Occurrence:—In crude diatomite "Celatom OD-100" in the lower bed. (Specimen. nos. 1766-1767)

2) A commercial diatomic suitable for an anti-caking against for ammonium nitrate and also for a general purpose filler.

Tetracyclus Celatom Okuno, sp. nov.

Text-fig. 1; Plate 35, Figures 3a-d.

Valvis panduraeformibus, ad polos rotundatis vel deltoideis. Long. 22–68μ, lat. 13–30μ, ad constrictionem 6–12μ. Costis mediis transverse parallelis, prope polos subradiantes, 2–3 in 10μ. Pseudoraphe linearibus, ca. 0.4μ lata. Striis mediis transverse parallelis, prope polos radiantibus, ca. 20–25 in 10μ, subtilissime punctatis, punctis ca. 30 in 10μ. Frustulis quadrangularibus, angulis obtusis, cum septis validis.

Valves panduriform with rounded to rounded-subacute ends. Length about 22–68μ; breadth about 13–30μ, at the constriction about 6–12μ. Costae transverse in the middle, subradiate at the ends, 2–3 in 10μ. Pseudoraphe linear, about 0.4μ broad. Striae about 20–25 in 10μ, transverse in the middle and radiate at the ends. In girdle view, frustules quadrangular. Septum with a distinct diaphragm at one end. This new species is somewhat similar to *Tetracyclus Peragalli* Héribaud and *T. javanicus* Hustedt, but from which it differs in several points as shown in the Table 1.

Table 1. Comparison of *Tetracyclus Celatom* with *T. Peragalli* and *T. javanicus*.

	T. Celatom	*T. Peragalli*	*T. javanicus*
Length (μ)	22–68	15–37	33–34
Breadth (μ)	13–30	15–21	13–14
End	round or rounded subacute	rostrate	subrostrate
Costae in 10 μ	2–3	3–6	3
Striae in 10 μ	20–25	?	18–20
Septum	present	?	?

Electron optically, the puncta of striae are revealed to be round holes, about 100–150mμ in diameter. In the present specimens, the holes are completely perforated, and showed no clear evidence of the presence of the closing membranes, though there is possibility of their presence in living forms. Holes about 3 in 1μ, in the middle of the valve, arranged in transverse rows, and at the ends arranged in radiating rows.

Habitat:—Fresh water, littoral.

Occurrence:—In the crude diatomite "Celatom OD-100" in the lower bed. (Specimen, no. 1726-type)

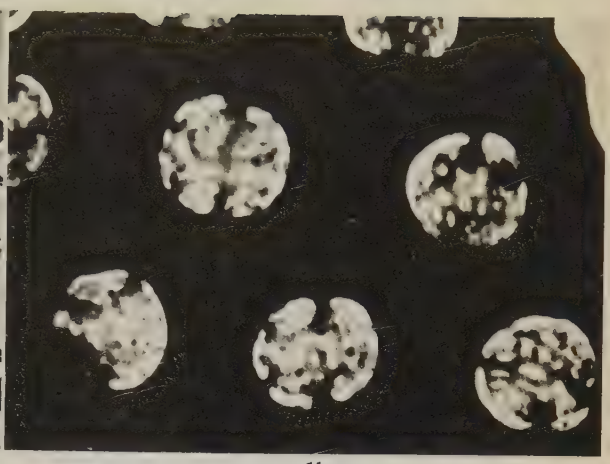
Explanation of Plate 34

L. M.: Light Micrograph. E. M.: Electron Micrograph.

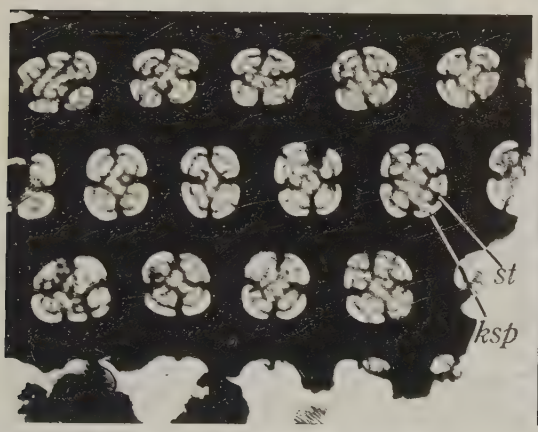
Figs. 1a-d. *Melosira granulata* (Ehrenberg) Ralfs. Near Lovelock, Nevada, U. S. A. 1a, ×900 (L. M.). 1b-d, Portions of mantles, showing fine structure of loculi. 1b, d, ×25000 (E. M.). 1c, ×13200 (E. M.).

Figs. 2a, b. *Melosira granulata* (Ehrenberg) Ralfs f. *curvata* Grunow. Near Lovelock, Nevada, U. S. A. 2a, ×1500 (L. M.). 2b, ×18000 (E. M.).

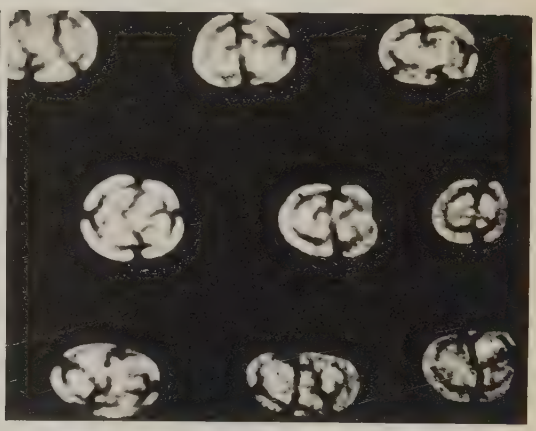
1a



1b

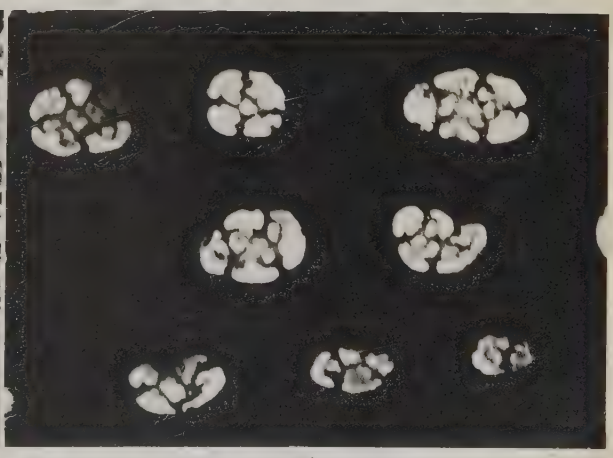


1c

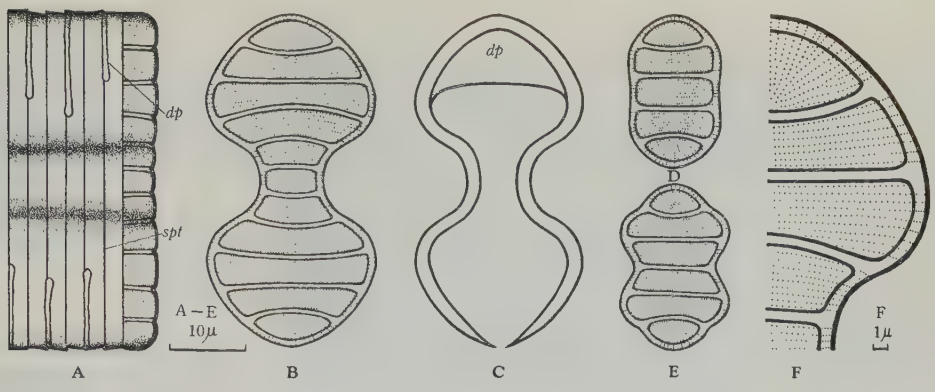


1d

2a



2b



Text-fig. 1. *Tetracyclus Celatom* Okuno, sp. nov.
A, Girdle view. B, D, E, Valve view. C, Septum. F, Portion of a valve, showing arrangement of the frustule pores. *dp*, Diaphragm of septum. *spt*, Septum. (Cf. Pl. 35, Figs. 3a–d.)

List of fossil diatoms found in the Celatoms

Celatom MN-35 (a refined commercial diatomite). *Occurrence*:—Storey County, 20 miles East of Reno, Nevada. Dominant: *Melosira distans* (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge (ca. 78%) (Pl. 35, Figs. 1a–h). Subdominant: *Mel. granulata* (Ehr.) Ralfs (ca. 20%). Companions: *Achnanthes lanceolata* Bréb. var. *rostrata* Hust. — *Cymbella tumida* (Bréb.) V. H.? (fragments).—*Fragilaria construens* (Ehr.) Grun. var. *venter* (Ehr.) Grun.—*Frag. Harrissonii* W. Sm. & var. *dubia* Grun.—*Frag. pinnata* Ehr. and var. *lancettula* (Schum.) Hust.—*Gomphonema intricatum* Kutz. — *Navicula bacillum* Ehr. — *Nav. pupula* Kütz.—*Nitzschia amphibia* Grun.—*Opephora Martyi* Hér.—*Synedra Vaucheriae* Kütz.—*Tetracyclus lacustris* Ralfs.

Celatom OD-100, crude. *Occurrence*:—Near Lovelock, Nevada. (Upper stratum.) Dominant: *Melosira granulata* (Ehr.) Ralfs f. *curvata* Grun. (ca. 99%) (Pl. 34, Figs. 2a, b) Companions: *Cocconeis* sp.—*Cymbella affinis* Kütz. var.? (Length 30–70μ. Breadth 12–17μ. Striae 7–10 in 10μ, punctate, puncta 12–15 in 10μ. On ventral side of the central area, with a stigma remarkably distant from the ventral median stria.)—*Melosira distans* (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge.—*Navicula cincta* (Ehr.) Kütz.? (fragments).— *Tetracyclus lacustris* Ralfs.

Celatom OD-100, crude. (Stratum immediately under the upper stratum.) Dominant: *Melosira granulata* (Ehr.) Ralfs (ca. 98%) (Pl. 34, Figs. 1a–d). Companions: *Cocconeis* sp. — *Fragilaria pinnata* Ehr.—*Frag. virescens* Ralfs.—*Gomphonema intricatum* Kütz.—*Gomph. bohemicum* Reich. et Fr.—*Melosira distans* (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge (++).—*Navicula cincta* (Ehr.) Kütz.—*Rhoicosphenia curvata* (Kütz.) Grun.—*Synedra Vaucheriae* Kütz.—*Tetracyclus rupestris* (A. Braun) Grun.

Celatom OD-100, crude. (Lower stratum.) There is no remarkable dominant diatom in the earth. *Caloneis amphisbaena* (Bory) Cl. var. *aequata* Kolbe.—*Cocconeis* sp.—*Cymbella cistula* (Hemp.) Kirch. (Pl. 35, Figs. 2a–c).—*Cym. Hauckii* V. H.?—*Cym. affinis* var.?—*Cyclotella* sp.—*Eunotia gracilis* (Ehr.) Rab.—*Eun. fallax* Cl. var. *gracillima* Krasske.—*Eun. pecti-*

nalis (Kütz.) Rab. var. *minor* (Kütz.) Rab. —*Fragilaria construens* (Ehr.) Grun. var. *venter* (Ehr.) Grun.—*Frag. pinnata* Ehr. var. *lancettula* (Schum.) Hust.—*Frag. virescens* Ralfs.—*Gomphonema intricatum* Kütz.—*Gomph. lanceolatum* Ehr. var. *insignis* (Greg.) Cl.—*Gomph. longipes* Ehr. var. *subclavatum* Grun.—*Gomph. parvulum* (Kütz.) Grun. var. *micropus* (Kütz.) Cl. —*Melosira distans* (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge(+++).—*Mel. granulata* (Ehr.) Ralfs (++).—*Mel. italica* (Ehr.) Kütz. (++).—*Mel. undulata* (Ehr.) Kütz. —*Meridion circulare* Ag.—*Navicula dicephala* (Ehr.) W. Sm.—*Neidium iridis* (Ehr.) Cl. var. *ampliata* (Ehr.) Cl.—*Nitzschia* sp.—*Pinnularia gentilis* (Donk.) Cl.—*Pinn. gibba* Ehr. var. *subundulata* May.? (Fragment)—*Pinn. major* (Kütz.) Cl. f. *hyalina* Hust.? (Fragments) — *Pinn. mesolepta* (Ehr.) W. Sm.—*Pinn. microstauron* (Ehr.) Cl. var. *biundulata* O. Müll.—*Pinn. viridis* (Nitz.) Ehr.—*Stauroneis phoenicenteron* Ehr.—*Synedra Vaucheriae* Kütz.— *Syn. ulna* (Nitz.) Ehr. var.?—*Tetracyclus Celatom* Okuno (++) (Text-fig. 1; Pl. 35, Figs. 3a-d).—*Tetr. lacustris* Ralfs.—*Tetr. rupestris* (A. Braun) Grun.

Erratum

In my previous paper (Okuno, 1956, *Trans. Proc. Palaeont. Soc. Japan. N. S., No. 21*, p. 136), I described—according to Mr. Neu's personal communication—the locality of the diatomite in which I found *Navicula maculata*, and var. *acuta*, *inflata*, *gigantea*, as "Near Basalt, Esmeralda County, Nevada". But recently Mr. R. S. MacMillan, the original collector of the diatomite, informed me that an exact description of the locality should be "Churchill County, 15 miles south of Fallon, Nevada, Upper Miocene or Lower Pliocene".

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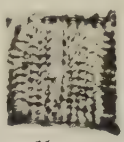
Explanation of Plate 35

Figs. 1a-h. *Melasira distans* (Ehrenberg) Kützing var. *lirata* (Ehrenberg) Bethge. Storey County, Nevada, U. S. A. 1a, Chain of frustules. ×1000 (L. M.). 1b, Girdle view of a frustule. ×1000 (L. M.). 1c-e, h, Valve views of frustules. (1c, focused on the valve surface. 1d, e, h, focused on the septum). 1d, e, ×1000 (L. M.). 1h, ×2500 (E. M.). 1f, Portion of a valve surface. ×25000 (E. M.). 1g, Portion of a mantle. ×25000 (E. M.).

Figs. 2a-c. *Cymbella cistula* (Hemprich) Kirchner. Near Lovelock, Nevada, U. S. A. 2a, ×400 (L. M.). 2b, ×1000 (L. M.). 2c, Portion of a valve, showing loculi. ×14000 (E. M.).

Figs. 3a-d. *Tetracyclus Celatom* Okuno, sp. nov. Near Lovelock, Nevada, U. S. A. 3a, b, Valve uiews (3b, abnormal form). 3a, ×800 (L. M.). 3b, ×1000 (L. M.). 3c, Septum, ×1000 (L. M.). 3d, End of a valve, ×6000 (E. M.).

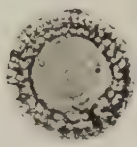
1a



1b

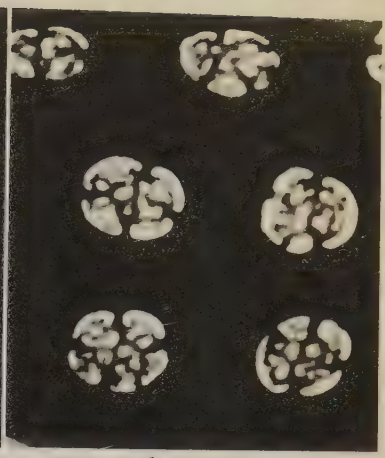
1d

1c

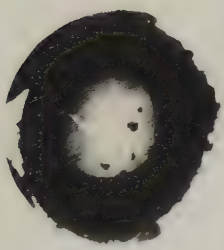


1e

1f

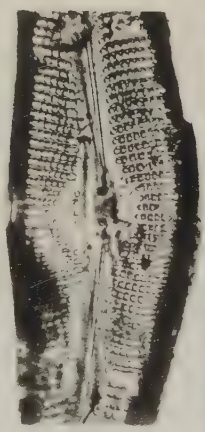


1g

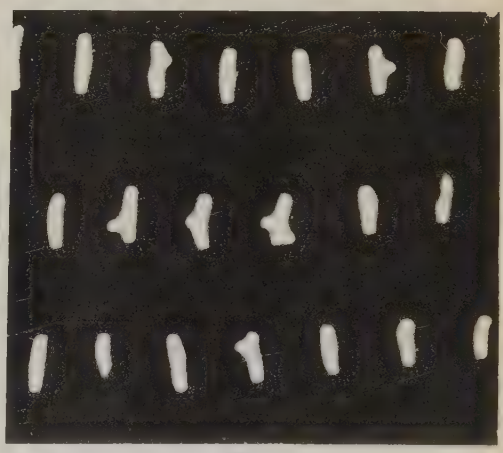


1h

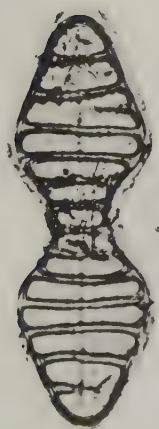
2a



2b



2c



3a

3b

3c

3d

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 31, pp. 243-247, pl. 36, Aug. 15, 1958

344. NEW FOSSIL *CHLAMYS* FROM THE ENVIRONS OF NAGANO CITY, JAPAN*

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Geological and Mineralogical Institute,
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長野市附近から産出した *Chlamys* の新種について：長野市の西方裾花川沿いに分布する，荻久保砂岩泥岩層から産出した *Chlamys* 属の一新種と一新亜種を記載した。　秋山雅彦

Introduction and Acknowledgements

During his palaeontological study of the molluscan fauna from the environs of Nagano City, the writer collected some interesting fossils of *Chlamys* from the Ogikubo sandstone and mudstone member (Tomisawa 1954). Of those *Chlamys* the writer discriminated one new species and one new subspecies, these are described in this article.

Acknowledgements are due to Dr. Masae Omori of the Geological and Mineralogical Institute, Tokyo University of Education for his kind supervision. Thanks are due to Professors. Haruyoshi Fujimoto, Wataru Hashimoto and Kotora Hatai, and Mrs. Shigeru Aoki and Saburo Akagi of the same Institute, for valuable suggestions and reading of this manuscript, and also to Mr. Kunio Tanaka of the Geological Institute, Shinsyu University, for his kindness to the writer during his field survey.

Systematic Description

Family Pectinidae

Subfamily Pectininae

Genus *Chlamys* (Bolten) Röding, 1798

Chlamys ingeniosa tanakai
Akiyama, n. subsp.

Plate 36, Figures 1, 2a, 2b, 3a, 3b.

Shell moderate in size, rather thin, higher than long, inequivalved, both valves somewhat convex, subequilateral except for ears; sides slightly concave above, base rounded. Right valve with 28 round-topped, imbricated radial ribs which are usually divided into two parts by a deep, longitudinal furrow near the umbomal area or undivided at the anterior; interspaces narrower than ribs themselves; intercalary threads usually appear at the upper one-fourth of the disc and are round-topped and imbricated; concentric striations inconspicuous; anterior auricle larger than the posterior, ornamented with 6 radial threads and furnished with deep byssal area; posterior auricle truncated behind, ornamented with 9 radial threads; hinge with 8 ctenoliums, cardinal crura, and deep resilial pit which is provided with lateral ridges on both margins. Left valve with 24–29 elevated, round-topped, imbricated, radial ribs which rarely accompany radial threads; interspaces broader than ribs near the ventral

* Received Dec. 21, 1957; read Sept. 28, 1957 at Kyoto.

margin; near the umbonal area there appear intercalary threads which are imbricated near the ventral margin; anterior auricle larger than the posterior, provided with numerous radial threads and fine concentric striations; posterior auricle truncated behind, ornamented with the same kind of sculpture as the anterior; hinge corresponding to the right valve.

Measurement in mm.:—

Reg. No.	L.	H.	D.	Hinge	H/L	D/L	Hinge/L	Apical angle	No. of ribs	Valve
5334	52	60	10	29.5	1.13	0.19	0.57	80°	28	Right
5336	52	60	12	29	1.13	0.23	0.56	75	26	Right
5337	46	50	10	23.5	1.09	0.22	0.51	80	28	Right
5338	52.5	62	14	28.5	1.18	0.27	0.54	75	22	Right
5339	29	38	5		1.31	0.17		80	23	Right
5340	26.5	34	3.5	12	1.28	0.13	0.45	77	21	Right
5341	24	29	4	13	1.21	0.17	0.54	75	22	Right
5342	39	47	8	23.5	1.20	0.21	0.60	75	24	Right
5343	45	51	6.5		1.14	0.14		80	23	Right
5344	44	50	6	24	1.14	0.14	0.55	85	29	Left
5345	33.5	37.5	6	15	1.12	0.18	0.45	85	27	Left
5346	67	73	14	36	1.09	0.21	0.54	85	27	Left
5347	45	49.5	7	25.5	1.10	0.16	0.57	90	29	Left
5348	52		10	26		0.19	0.50	75	29	Left
5349	47.5	59	11	31	1.24	0.23	0.64	80	26	Left
5350	65.5	71	10	32	1.09	0.15	0.49	80	25	Left

Remarks:—This subspecies is characterized by the right valve which is provided with 21–28, imbricated, radial ribs which usually split into two unequal parts by furrow. The left valve is characterized by 24–29, round-topped, imbricated, radial ribs which sometimes accompany radial threads. An intercalary thread is developed in each interspace of the left valve as well as of the right one. The number of radials varies between 21 and 28 on the right valves.

This new subspecies is named in honor of Mr. Kunio Tanaka, of Shinsyu University, who helped the writer in his field survey.

The present new subspecies is allied to *Chlamys ingenisa* (Yokoyama) (1929, p. 5, pl. 6, fig. 2) in its surface sculpture, but the former can be distinguished from the latter by the much higher shell with smaller apical angle and thinner hinge provided with more rounded resilial pit. Yokoyama's species was based upon a single right valve which was collected by him from the Noto Peninsula, and no subsequent records of its occurrence has been published. This subspecies also resembles *Chlamys hastatus hindsii* (Carpenter) (Arnold, 1906, p. 110, pl. 43, figs. 3, 3a) living in the Bering Sea as well as along the west coast of North America and also as fossil in California, but it is distinguishable therefrom in having more imbricated ribs and undivided radials of the left valve. This subspecies is related to *Chlamys islandicus* (Müller) (Grant and Gale, 1931, p. 161, pl. 11, fig. 1) from the Banks of Newfoundland,

which has more numerous and less imbricated radials, and is somewhat related to *Chlamys branneri* (Arnold) (1906, p. 55, pl. 3, figs. 9–11) from the Vaqueros formation of California which has broader furrows on the radials of the right valve and larger posterior ear of the left.

Chlamys arakawai (Nomura) (1935, p. 4, figs. 1–2; Masuda, 1954, p. 150, pl. 19, figs. 1–6.) from the Moniwa formation is a related species to the present one, but the latter is distinguishable from the former in having fewer radial ribs which bifurcate near the beak and in having a thinner hinge plate. Another related species to the present one is *Chlamys hataii* Masuda and Akutsu (1956, p. 130, pl. 20, figs. 1–9,) from the Nagaoka formation, Tochigi Prefecture, which has less numerous and broader ribs that bifurcate only on the lower half of the disc.

Localities and Horizon:—Loc. 2*, Kawashita, Togakushi-mura, Kamiminochi-gun. Lat. 36°40′14.5″N, Long. 138°5′46″ E. Loc. 11*, Shimoniregi, Togakushi-mura. Lat. 36°40′12.8″N, Long. 138°5′24″ E. Ogikubo sandstone and mudstone member.

Repository:—The Geological and Mineralogical Institute, Tokyo University of Education; Reg. Nos. 5334 (Holotype), 5336–5350.

* This locality number is shown by Tomisawa (1953, p. 559) in his geological map.

Chlamys obesa Akiyama, n. sp.

Plate 36, Figures 4a, 4b, 5a, 5b, 6a, 6b.

Shell medium in size, rather thick, subequilateral, inequivalved; both valves convex; the height equal to the length, sides slightly concave above, apical angle about 85 degrees, base rounded.

Right valve provided with 27 round-topped, scaly, radial ribs, which are divided into three unequal parts by two shallow furrows on the upper one-third of disc in the central part; on the other, they are divided into two parts on the upper-fourth of disc below or remain undivided at submargins; interspaces narrow than ribs themselves, with scaly intercalary threads which appear first on the upper one-fourth of disc; anterior auricle much larger than the posterior, sculptured with 4 radial threads and inconspicuous, concentric lines and provided with deep byssal notch, wide byssal area and 4 ctenolia; posterior auricle sculptured with 8 radial threads; hinge provided with conspicuous cardinal crura and large, deep and rounded resilial pit which has lateral ridges on both sides. Left valve sculptured with 24, scaly, round-topped ribs which rarely accompany radial threads on one side and rarely bifurcate at ventral margin; interspaces as wide as ribs themselves and provided with rather elevated, scaly, intercalary threads; anterior auricle much larger than the posterior and

Measurement in mm.:—

Reg. No.	L.	H.	D.	Hinge	H/L	D/L	Hinge/L	Apical angle	No. of ribs	Valve
5351	57.4	58	12.4	32	1.01	0.22	0.56	85	27	Right
5352	58	58	12	28	1.00	0.21	0.48	85	24	Left
5335	61	61	15	34	1.00	0.27	0.52	85	26	Right

sculptured with 9 radial threads and concentric striations; posterior auricle rectangularly truncated behind and ornamented with 4 radial threads; hinge provided with a resilial pit and cardinal crura, corresponding to that of the right.

Remarks:—This new species is characterized by the rather thick, subequilateral shell of which length is equal to the height. The right valve is characterized with 26–28 scaly radial ribs, which has two furrows in the centre of the disc. Left valve has different sculpture from the right one and is sculptured with 24, scaly, round-topped radials which rarely accompany a radial thread on one side. An intercalary thread is developed in each interspace of left valve as well as the right one.

The present species is allied to *Chlamys kotorana* Otuka, (1934, p. 611, pl. 47, fig. 25), but the former is distinguishable from the latter in less inequilateral form with regular and numerous radials, more produced beak and broader interspaces. *Chlamys kotorana* was based upon a single left valve which was collected by Otuka from the Suenomatsuyama "Series" (Otuka, 1934) and no subsequent record of its occurrence has been published. So, the writer is not able to know the characters of the right valve of *kotorana*. Unfortunately Otuka's holotype specimen has disappeared from his collection in the University of Tokyo.

This new species is closely allied to *Chlamys ingeniosa tanakai* in the preceeding, but can be distinguished by having much longer and thicker shell with radials which are tripartite by shallower furrows in the right valves. Another allied species is *Chlamys kaneharai* (Yokoyama) (1926, p. 135, pl. 18, fig. 1, pl. 19, figs. 1, 2, 5–7, Masuda, 1956a, p. 176, pl. 28, figs. 1–7), which has larger and longer shell of which radials are sculptured with two radial furrows in the right valve as well as in the left. *Chlamys miyatokoensis* (Nomura and Hatai) (1936, p. 127, pl. 19, figs. 2, 4, pl. 20, fig. 1, Masuda, 1956b, p. 247, pl. 35, figs. 1–9.) is also allied to the present species, but can be distinguished from the latter by the sculpture of the left valve.

Locality and Horizon:—Loc. 11, Shimoniregi, Togakushi-mura, Kamiminochi-gun. Lat. 36°40′12.8″N., Long. 138°5′24″ E. Ogikubo sandstone and mudstone member.

Repository:—The Geological and Mineralogical Institute, Tokyo University of Education, Reg. Nos. 5351 (Holotype), 5335, 5352.

Explanation of Plate 36

Fig. 1. *Chlamys ingeniosa tanakai* Akiyama, n. subsp., Paratype, Reg. No. 5347, Left valve ×1, Loc. Kawashita, Togakushi-mura, Kami-minochi-gun, Nagano Prefecture.

Figs. 2a-b. *Chlamys ingeniosa tanakai* Akiyama, n. subsp., Holotype, Reg. No. 5334, a. Right valve ×1, b. Hinge area of 2a. ×1. Loc. Same as above.

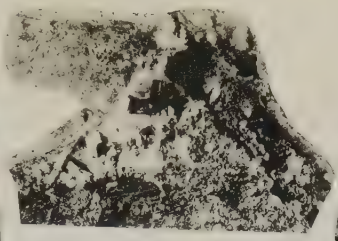
Figs. 3a-b. *Chlamys ingeniosa tanakai* Akiyama, n. subsp., Paratype, Reg. No. 5349, a. Left valve ×1, b. Hinge area of 3a ×1, Loc. Same as above.

Figs. 4a-b. *Chlamys obesa* Akiyama, n. sp., Holotype, Reg. No. 5351, a. Right valve ×1, b. Hinge area of 4a ×1, Loc. Shimonigeri, Togakushi-mura, Kami-minochi-gun, Nagano Prefecture.

Figs. 5a-b. *Chlamys obesa* Akiyama, n. sp., Paratype, Res. No. 5352, a. Hinge area of 5b ×1, b. Left valve ×1, Loc. Same of above.

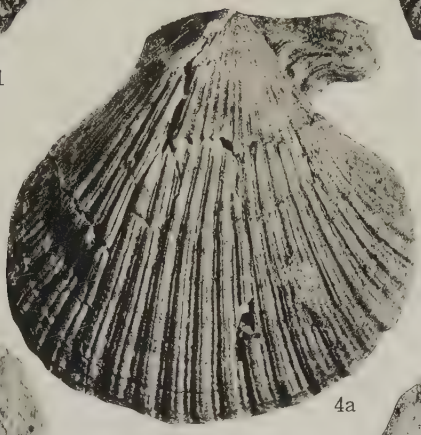
Figs. 6a-b. *Chlamys obesa* Akiyama, n. sp., Paratype, Reg. No. 5335, a. Right valve ×1, b. Hinge area of 6a ×1, Loc. Same of above.

1



2b

2a



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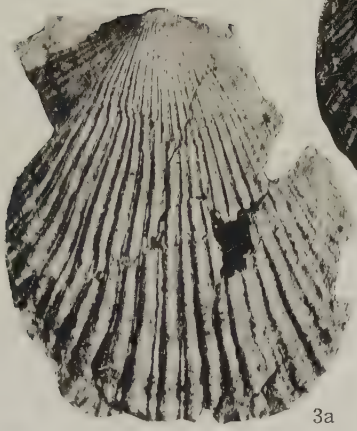
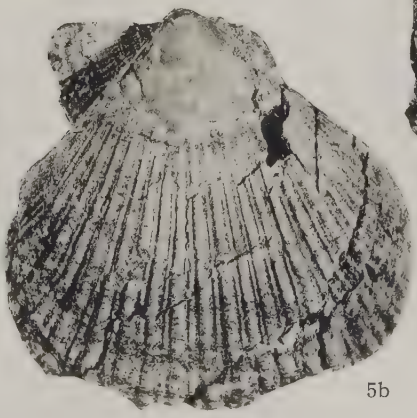


3a

3b

5a



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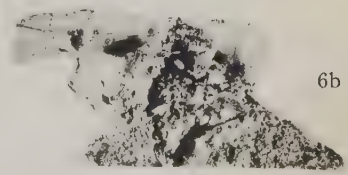

6b

S. Aoki Photo.

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345. A GOTLANDIAN NAUTILOID FROM THE HIDA PLATEAU IN JAPAN*

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飛騨高原産后烏紀瀧鶴貝： これまでに知られている本邦産古生代頭足類は 20 種に満たない。 そして皆二疊石炭紀のものである。ここに記載する "*Michelinoceras*" *hidense* は福地層の上部から出土したもので，その時代は恐らく后烏紀後期であるから，日本最古の頭足類化石である。 更にこの機会に Michelinoceratida を Sinoceratida と改称す可きことを説く。 小 林 貞 一

A fossil hunting party visited Fukuji area in the eastern Hida plateau last summer where Gotlandian and Devonian fossils are known to occur. Mr. Takashi Fujita of the party was fortunate enough to collect an orthoceroid at a fossil locality of Fukuji and send it to me through Mr. Tadao Kamei, lecturer of the Shinshu University for identification.

According to Kamei the fossil was found among boulders derived from the *Cystiphyllum*-bearing limestone near the top of the Gotlandian Fukuji formation, instead of the Devonian Takaharagawa formation. This limestone (7 in Kamei's section, 1955) is located in the lower part of the *Favosites uniformis igoi* (or F_{2b}) zone by Kamei and the horizon whence the orthoceroid is judged to have been derived lies a little below its boundary with the middle calcareous shale (8 in Kamei's section). The age of the cephalopod is evidently older than the Emsio-Couvinian or Koblenz-Eifelian Takaharagawa formation (11 in Kamei's section) whence *Cheirurus* (*Crotalocephalus*) *japonicus* was recently described by Igo and myself (1956). Therefore it may be Ludlovian, if not Gedinnian.

In Japan Palaeozoic cephalopods are exceedingly rare. As enumerated below, those so far known are less than 20 species and all procured from the Permo-Carboniferous formations.

Nautiloidea.

1. *Protocycloceras* cfr. *cyclophorum* Waagen by Hayasaka, 1924b, i. e. *Cycloceras* sp. nov. by Shimizu and Obata, 1936, from the Upper Permian Ogachi slate formation in the Kitakami mountains.
2. *Metacoceras* sp. by Yabe and Mabuti, 1935, from the Permian Maiya series in the Kitakami mountains.
3. *Coelonautilus* sp. indt. by Hayasaka, 1954a, from the lower or Hinotsuchi stage of the Tournaisian Arisu series in the Kitakami mountains.
4. *Koninckioceras* sp. by Hayasaka, 1954b, from the Middle Permian Akasaka limestone in Province Mino, Gifu Prefecture.
5. *Foordiceras whyneiforme* Hayasaka and Ozaki, 1954, from the Permian Oguradani bed II containing fragmentary *Lyttonia*, in Prov. Echizen, Fukui Prefecture.
6. *Tainoceras abukumaense* Hayasaka, 1957, from the Middle Permian of the Abukuma mountains.

* Received Jan. 29, 1958; read at the Annual Meeting of the Palaeontological Society of Japan at Sendai, Feb. 2, 1958.

7. *Tylonautilus permicus* HAYASAKA, 1957, from the same locality as the preceding.

Ammonoidea.

1. *Gastricoceras* a sp. by YABE, 1904, from the Middle Permian of Kobama in the Kitakami mountains.
2. *Gastricoceras* b sp. by YABE, 1904, from the Permo-Carboniferous Omi limestone in Prov. Echigo, Niigata Prefecture.
3. *Stacheoceras iwaizakiense* MABUTI, 1935, from the Middle Permian Iwaizaki limestone in the Kitakami mountains.
4. *Stacheoceras* sp. indt. by HAYASAKA, 1940, from the Middle Permian Kanokura stage (?) of Kobama in the Kitakami mountains.
5. *Paraceltites* cfr. *elegans* GIRTY by HAYASAKA, 1940, from the Kanokura stage of Imo in the Kitakami mountains.
6. *Gastricoceras* c sp. indt. by HAYASAKA, 1954a, from the Tournaisian Arisu series in the Kitakami mountains.
7. *Prolecanites* (?) a sp. indt. by HAYASAKA, 1954a, from the upper or Jumonji stage of the Tournaisian Arisu series and the lower part of the Etroeungtian Hikoroichi series in the Kitakami mountains.
8. *Prolecanites* (?) b sp. indt. by HAYASAKA, 1954, from the Jumonji stage in the Kitakami mountains.
9. *Medlicottia* (?) sp. by HAYASAKA, 1954, from the younger Permian of Tasobe-village in the Kitakami mountains.
10. *Hanieloceras intermedium* (WANNER) by HAYASAKA, 1954a, from the upper Kanokuro series (Kazanian) of the Katchizawa in the Kitakami mountains.

They are each represented by one or a few specimens, mostly imperfect or crudely deformed. There is no locality in the Palaeozoic of Japan so rich in cephalopods that it can be called "Cephalopod facies." All of these species are coiled except the first one which is an annulated orthocone. The Fukuji specimen is another orthocone, also not well preserved, but I think it worthwhile to record its occurrence, because it is the oldest among the cephalopods in Japan. For the study of such a rare specimen I thank its collecter and sender.

Merit to TROEDSSON (1931), TEICHERT and MILLER's inspections (1936, 38 and 40), it was dug out from old literatures that *Orthoceras* DESHAYES, 1831, is a homonym of *Orthoceras* BRUGUIÈRE, 1789, which is in turn a synomyn of *Hippurites*. *Orthoceros* BRÜNNICH, 1771, is on the other hand valid as a generic name of straight nautiloids as typified by *Orthoceratites regularis* SCHLOTHEIM, 1820. According to TEICHERT (1928) and TROEDSSON (1931) this species is a long narrow straight nautiloid having a few prominent, but short longitudinal grooves on the living chamber and sometimes a broad shallow transverse constriction near the apparture and occurring in situ in the Orthocerenkalk in the Baltic region.

Because *Orthoceros* is typified by such an unusual orthoceroid, FOERSTE (1932) proposed *Michelinoceras* for the substitute of *Orthoceras* as a form genus of nautiloids. Its type species is *Orthoceras michelini* BARRANDE from the E stage in Bohemia. The invalidity of *Orthoceras* DESHAYES means at the same time that of the Orthoceratidae HYATT, 1900. Therefore TEICHERT and MILLER (1936) changed the family name from Orthoceratidae to Orthocerotidae. Later, however, FLOWER (1945) proposed Michelinoceratidae to replace Orthocerotidae by the reason that Orthocerotidae is easily confused with Orthoceratidae.

Prior to this SHIMIZU and OBATA (1935) created *Sinoceras* on *Orthoceras chinense* FOORD in YÜ, 1930, which is characterized by long septal necks and ventrally (?) sinuated striae of different strengthes. They proposed further a new family, Sinoceratidae. *Sinoceras* is indeed a distinct genus, but I cannot see sufficient

distinctions to segregate the Sinoceratidae out of the Orthocerotidae or Michelinocerotidae. If they are inseparable in the family rank, the earlier one is valid and accordingly the Michelinoceratida FLOWER, 1950, should be replaced by Sinoceratida, nov.

Michelinoceras hidense KOBAYASHI, new species

Plate 37, Figures 1-7.

The specimen is a straight phragmocone, about 40 mm. long. Its cross section is subelliptical, or better to say, more strongly convex on one side than on the other which is presumed ventral. The major and minor diameter is respectively 24.3 mm. and 19.2 mm. at the adoral end and 21.2 mm. and 17.2 mm. at the adapical end. In other words the major diameter increases with the rate of 1 mm. in the length of about 1 cm., while the rate of expansion is about a half reduced for the minor diameter. In the longitudinal section along the minor diameter 6 septa and 5 camerae are countable in the length of 30 mm. The septal distance is 7 mm. at the most adapical camera, while it becomes 7.5 mm. on the other side. The septa are moderately concave, the concavity corresponding to a half of the septal distance. The septal neck is of moderate size, gently and regularly curved inward, the curvature suggesting that the connecting ring is expanded to some extent between the necks. None of the rings is, however, preserved. This fact suggests that the septa are ellipochoanoidal and the connecting rings liable to destruct or dissolve. At the same time it means that there was no intracameral or intrasiphuncular deposit which protects the disappearance of the rings. The siphuncle is probably subtubular. It is located almost at the center, but evidently closer to the venter than the dorsum near the adoral end. There it measures 3.25 mm. across at the neck. The siphuncle and camerae are filled with dark gray dirt. Externally, the septal sutures are transversal and neither saddle nor lobe is discernible. Test is unpreserved and surface unknown, but at least there is no reason to imagine any kind of annulations or longitudinal ridges. Unfortunately the specimen is not accompanied by its external mould and nothing cannot be said definitely about the surface ornamentation.

There is a peculiar groove on the ventral side, but it may be accidental, because it is oblique to the axis and not persistent. Otherwise, there is no crack or any uneveness on the surface. Internally, the septa proper are undamaged. Therefore it is understood that the secondary deformation was slight and the subelliptical cross section of the conch is scarcely removed from the original one.

Comparison:—Michelinoceras is a form genus which needs a thorough revision. It includes smooth orthocones, circular or subcircular in cross section, their siphuncles being exactly or approximately centren and tubular or subtubular. In this species the cross section is subelliptical and more flattened on the ventral than the dorsal side. The siphuncle is subcentral in the early stage, but becomes excentric by detaching from the dorsal wall. The septal neck is largely and strongly hooked. The combination of these specialities shows that this species is by no means diagnostic of *Michelinoceras*, but for the time being it is placed in the genus, because its preservation is too poor to consider its generic or subgeneric separation.

FLOWER (1945) established *Arkonoceras*

for *Orthoceras arkonense* Whiteaves which has a smooth shell compressed in cross section with an excentric siphuncle. Its excentricity is so high that it is found at the midway between the center and the shell wall. The septal sutures describe gentle ventral and dorsal saddles separated by lateral lobes in *Arkonoceras arkonense*, whereas they are simply transversal in this species.

Occurrence:—Uppermost part of Fukuji formation (probably Ludlovian), at Fukuji, Kamitakara village, Yoshiki county, Prov. Hida, Gifu Prefecture.

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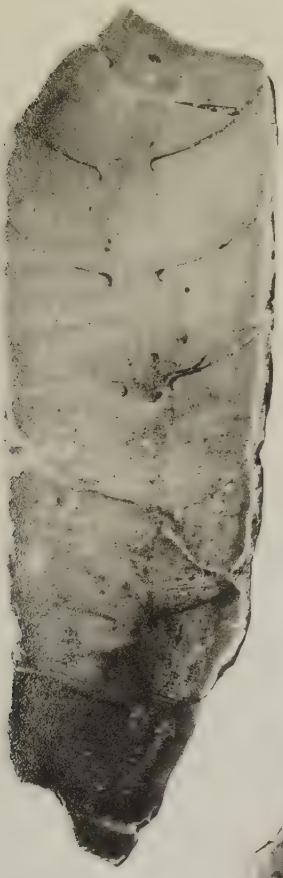
Explanation of Plate 37

Michelinoceoas hidense KOBAYASHI, new species.

Figure 1. Ventral view showing transverse septal sutures and an accidental depression. ×1.5
Figure 2. Lateral or right side view showing transverse sutures. ×1.5
Figure 3. Dorsal view. ×1.5
Figure 4. Longitudinal polished section along the short diameter. ×2
Figure 5. Polished section showing two septa. ×3. Retouched.
Figure 6. Adapical view. ×1.5
Figure 7. Diagrammatic Cross section. ×1.5



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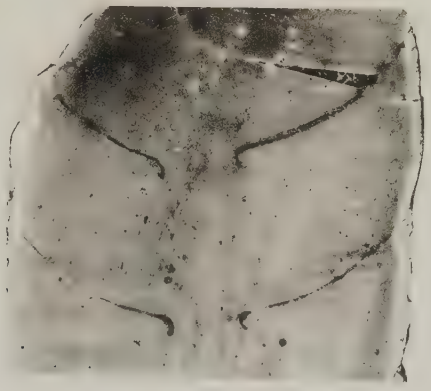

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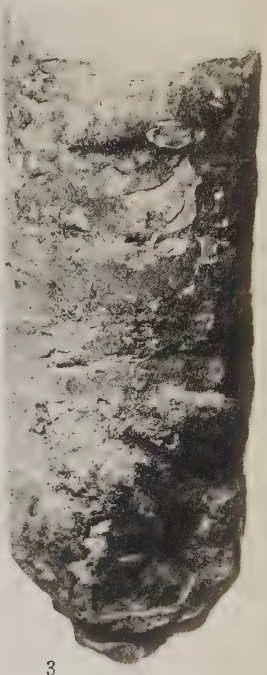

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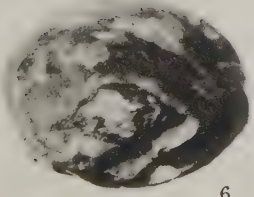

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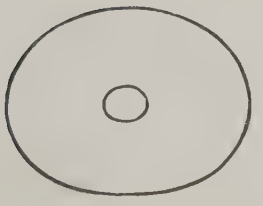

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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 31, pp. 253-264, pl. 38, Aug. 15, 1958.

346. *GRANULIFUSUS* FROM THE MIYAZAKI GROUP (PALAEONTOLOGICAL STUDY OF THE MIYAZAKI GROUP—V)*

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宮崎層群産の *Granulifusus*：黒田と波部 (1952, 54) は *Fusinus niponicus* Smith を模式種として，新属 *Granulifusus* を創設した。横山 (1928) の記載した宮崎層群 の *Fusus dualis* はこの属に含まれるのである。宮崎層群からは，この *dualis* のほか，二新種が産出する。*Granulifusus* に特徴的な形態とその発生の比較にもとづいて，これら三種と，既知の現生および化石の種との関係を検討した。

首 藤 次 男

Introduction

Having distinguished a particular form from the species group of the genus *Fusinus* Rafinesque 1815, Drs. T. Kuroda and T. Habe have recently established a new genus *Granulifusus* based on *Fusinus niponicus* (Smith) (Smith, 1879, p. 203, pl. 20, f. 34) as the type species. According to them "the shell characters of this species do not agree with those of *Fusinus* in having a few granulated spiral series on the surface and the aperture gently narrowed to the siphonal canal without any constriction. The operculum of this species is very small, thick and ovate, nucleus of which is situated eccentrically, not terminally as in many species of *Fusinus* and the radula also bears a small number of cusps on the lateral tooth." These are the reasons why they established a new genus and I agree with their conclusion. Since the original authors did not refer to the neccesary comparison of the present genus to its allied genera except *Fusinus* (s. s.), a concise review is given here.

Granulifusus more resembles *Propefusus* Iredale 1924 with the type species *Propefusus pyrulatus* (Reeve) than *Fusinus* (s. s.) in its aperture and the ornamentation. But *Propefusus* has shorter shell ornamented with less granular projections than *Granulifusus*.

Buccinofusus Conrad 1863 with the type species *Buccinofusus parilis* Conrad also shows some resemblance with the new genus in its aperture, but the former has the bended and shorter canal than the latter and its operculum is nucleated at the anterior end.

Granulifusus includes three living species in Japan. They live altogether on the sandy bottom of the subneritic *fascia* of the Pacific surrounding south Japan where the water is affected by the warm Kuroshio current. The genus is, therefore, one of the typical elements of the Kuroshio fauna. Although the exact range of the geographical distribution of the genus is not known, "*Fusus rufinodis*" v. Martens from the Indonesian region seemingly is, so far

* Received Jan. 16, 1958; read at the meeting of West Japan Section, Geological Society of Japan, Fukuoka, July 1, 1956.

has been known, only a representative of the foreign species of *Granulifusus*. That shows a possibility that the genus is one of the Indo-Pacific elements.

Among the fossil fauna three species of the genus have been known from the Neogene strata of the Pacific side of southwest Japan. *G. dualis* (YOKOYAMA) (YOKOYAMA, 1928, p. 344, pl. 67, f. 3) was reported from the Miyazaki group of Kyushu and the Tônohama group of Shikoku. *G. makiyamai* (OTUKA) (YOKOYAMA. 1920, p. 49, pl. 2, f. 7 as *Fusus niponicus* SMITH; OTUKA, 1937, p. 1008 as *Fusinus makiyamai;* TAKI and OYAMA, 1954, p. 23) and *G. musashiensis* (MAKIYAMA) (YOKOYAMA, 1922, p. 52, pl. 2, f. 11 as *Fusus niponicus* SMITH; MAKIYAMA, 1931 as *Fusinus niponicus musashiensis;* TAKI and OYAMA, 1954, p. 23) occur from the Miyata and the Semata formation of south Kwanto, respectively.

From the Miyazaki group a few allied forms have been found besides *G. dualis*. Though their operculum has not been found yet, they are reasonably identified to that genus on the basis of the shell form and the ontogeny.

In this paper the descriptions of the four species including new two ones and the consideration on the evolution of the species in relation to their ontogeny and the stratigraphic occurrence are given.

Systematic Description

Fusidae D'ORBIGNY 1843

Granulifusus KURODA and HABE, 1952

(type species: *Fusinus niponicus* (SMITH) by original designation)

As given in the original description the shell of the genus consists of the convex and angulated numerous whorls, which are provided with a few distinct spiral ribs, the interjacent numerous fine spiral lines and the strong axial plicae. The crossings of the spiral ribs and the axial plicae are raised to become the distinct nodes which are compressed axially and elongated spirally. The details of these features are very important for the comparison of the morphology and the ontogeny among the species. For instance in *G. niponicus* the penultimate whorl shows rather rounded profile with four angulations which coincide with the distinct spiral ribs. These angulations, for convenience, are called (a), (b), (c) and (d) in ascending order respectively (text-fig. 2). The primary rib corresponding to the angulation (a) is denoted by 1a and so on. 2f, 2g, 2h, 2i and 2j mean the secondary spirals interjacent between the nagulation (a) and the lower suture, between (a) and (b), (b) and (c), (c) and (d) and between (d) and the upper suture respectively (text-fig. 3). These primary and secondary threads appear with divergent strength at the different stage of growth among the species.

These notations are adopted in the description of the species in the following pages.

Granulifusus dualis (YOKOYAMA)

Plate 37, Figures 5, 6, 10, 11 and 12.

1928, *Fusus dualis* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, sec. II, vol, 2, pt. 7*, p. 344, pl. 67, fig. 3.

1929, *Fusus dualis*, YOKOYAMA, *Imp. Geol. Surv. Japan Rep. no. 104*, p. 12, pl. 7, fig. 5.

Material:—GK-L 15071 to 15072, 15086 to 15088 and 15105 to 15109 from the type locality Hagenoshita, Uwaye mura collected by Professor T. MATSUMOTO and the second year students of the Department of Geology of the Kyushu

University in 1938; 15083 to 15085 and 15089 collected from Tôriyama, Kawaminami mura by myself.

The fossil occurrence is common and the preservation is complete. The matrix is fine sand at Hagenoshita and tuftaceous muddy sand at Tôriyama.

Measurements:—Shown in table 1.

Remarks:—The protoconch is round and smooth except for the minute lines of growth and consists of one and a half whorls, which are very constant in number though the original author described the protoconch of two whorls. On the post-nuclear whorls, especially on the adult whorls, a distinct angulation (a) is situated at two-fifths of the whorl-height from the lower suture in almost all specimens, but in the rare exceptions it is at the lower third to fourth as indicated in the original description. The surface below the angulation is rather variable in attitude, namely, it is almost vertical or slightly receding in general, but in some cases it is even sloping. The first post-nuclear whorl shows the tri-angulated outline (angulation (a), (b) and (c)), but the angulations except for (a) are weakened rapidly as the shell grows and on the third whorl they can hardly be traced. This results the surface above (a) is almost flat. In the greater number of the specimens another angulation (e) is concealed by the next whorl just below the suture (text-fig. 2, *dualis* b), but in a considerable number of the specimens it is not covered and visible from outside close to the lower suture to form the bi-angulated outline (text-fig. 2, *dualis* a). The other characteristics are not so variable and quite agreeable with the original description.

There is no apparent difference in the form characters between the specimen

Table 1. Measurement of the selected specimens of *Granulifusus* from the Miyazaki Group.

specimen reg. no. GK-L	species	locality	height of the shell (mm)	largest diameter of the shell (mm)	height of the spire (mm)	apical angle (degrees)
15071	*dualis*	Hagenoshita	16.8	6.0	4.2	42
15072	*dualis*	Hagenoshita	37.5	14.1	11.8	43
15073	*dualis*	Hagenoshita	33 ca	11.7	11 ca	43
15074	*dualis*	Hagenoshita	23.5	9.8	9.9	42
15075	*dualis*	Hagenoshita	29 ca	11.5	11.4	44
15076	*dualis*	Hagenoshita	31.2	11.9	12.8	41
15078	*dualis*	Hagenoshita	23 ca	9.4	11.2	43
15079	*dualis*	Hagenoshita	31.4	12.5	11.6	47
15080	*dualis*	Hagenoshita	31.5	12.7	12.5	45
15081	*dualis*	Hagenoshita	27.5	10.3	11.0	44
15084	*dualis*	Tôriyama	36.3	14.2	13.7	47
15085	*dualis*	Tôriyama	31.3	11.7	12.0	45
15086	*dualis*	Hagenoshita	29.0	11.2	11.0	43
15087	*dualis*	Hagenoshita	29.6	10.4	12.3	43
15101	*matsumotoi*	Hagenoshita	31.9	12.1	8.3	40
15102	*matsumotoi*	Hagenoshita	33 ca	11.2	11.9	40
15091	*koyuanus*	Azukino	33 ca	12.4	11.3	45
15092	*koyuanus*	Azukino	23.7	9.5	7.3	46

groups from Hagenoshita and Tôriyama which are quivalent in time to H1a and H1b (Ikebe, 1954, p. 74), respectively.

Horizon.—The middle and the upper Takanabe member (Lowest and Lower Pliocene).

Localities.—Hagenoshita,[1] Uwaye mura; Tôriyama,[2] Kawaminami mura, Koyu gun, Miyazaki Prefecture.

Granulifusus koyuanus n. sp.

Plate 37, Figures 9 and 13.

Material:—Holotype, GK-L 15091; paratypes, GK-L 15092 to 15095. All the specimens came from the calcareous nodules in the siltstone at Azukino (MI-4853), Mino mura, Koyu gun. The detached specimens are not perfect in details because of the difficulty in cleaning, though the preservation in the nodules is very complete.

Measurements:—Shown in table 1.

Diagnosis:—The shell is moderate in size and in thickness and fusiform with the high spire which consists of one and a half whorls of the protoconch and about six to seven post-nuclear whorls. The protoconch is smooth and rounded but not well observed in detail. The post-nuclear whorls are angulated and sculptured with the axial plicae and the spiral threads. On the early whorls the axial plicae are stronger than the spirals which are composed of the rows of the granules on the plicae at the early stage and soon become the continuous threads.

The first whorl has three primary spirals, 1e, 1a and 1b, and one secondary spiral, 2c, of which the second one from the lower suture, 1a, is largest and makes the angulation; the lowest one, 1e, is close to the suture and moderate in size; the third, 1b, is rather weak and the uppermost one, 2c, appears a little later and considerably weak to compare with the primary spirals. On the second whorl two secondary and two tertiary spirals appear on each interspace between the foregoing spirals and the upper suture. They are namely 2g, 2f, 3h and 3d in ascending order. The other tertiary spirals appear on the third or fourth whorl and the quatery and the lower-order spirals are rather irregular in the order and the position of appearence. The axial plicae are broadly rounded and strongest on the angulation, weaken both above and below and about 11 to 12 in number on the first whorl, 10 on the adolescent and 10 to 11 on the ultimate.

The penultimate whorl is angulate at two-fifths of the whorl-height from the lower suture with the surface above the angulation slightly convex and steeply sloping and below somewhat concave and slightly receding. Two primaries, 1e and 1a, form the blunt tubercles on the crossings with the plicae. The tubercles are spirally elongated and stronger on the angulation (a) than on the basal rib 1e. 1b is rather weak and 2c is hardly distinguished from other secondary ribs or tertiary threads which are numerous and close set. The growth-lines are fine, distinct and slightly sinuoused. The aperture is fusiform and pointed behind and does not contract abruptly at the lower part. The outer lip is thin with a plica outside and the inner lip smooth with the thin callus. The canal is long and slightly bend sideward. The fasciole does not develop.

Comparison:—The present new species is closely allied to *G. dualis* (Yokoyama), especially to the form with a basal primay spiral. The ontogenetic growth of the spiral sculpture is quite identical

1) 宮崎県児湯郡上江村元の下
2) 同　　川南村通山

between the two in the early stage, but in the later stage the primaries and the secondaries on the rump become weak rapidly in *G. dualis* and they hold the original strength in *G. koyuanus*. Furthermore the surface below the angulation (a) is slightly concave in the former and rather strongly so in the latter. The axial plicae are more numerous in the former than in the latter.

Horizon:—The upper part of the Kawabaru member (lower Upper Miocene).

Locality:—Azukino,[1] Mino, mura, Koyu gun, Miyazaki Prefecture.

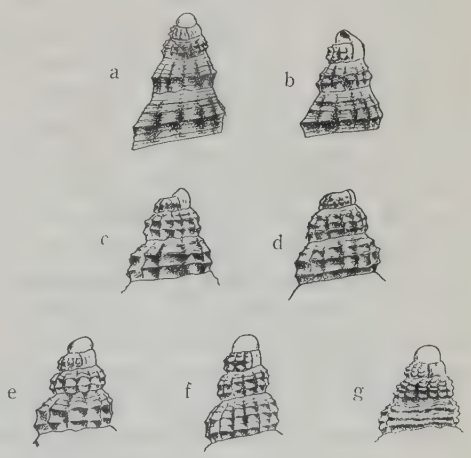
Granulifusus matsumotoi n. sp.

Plate 36, Figures 3, 4, 7 and 8.

Material:—Holotype, GK-L 15101; paratypes, GK-L 15102 to 15104. All the specimens came from the fine sand bed intercalated in the silty strata. Collectors, Professor T. Matsumoto and the second year students of the Department of Geology of Kyushu University in 1938 (GK-L 15101, 15103 and 15104) and myself (GK-L 15102).

Measurements:—Shown in table 1.

Diagnosis:—The shell is moderate in size and thickness, fusiform and with the high and straight-sided spire. The apex is small, smooth, rounded and consists of one and a half whorls of the protoconch. The post-nuclear whorls are about six in number, angulated and sculptured by the axial plicae and the spiral threads. Three primary spirals (1a, 1b and 1c) of almost equal size appear at the beginning of the first whorl. They consist of three spiral rows of granules at first and become the continuous ribs on the second whorl, where the upper one is so weak that the profile of the whorl is bi-angulate. Of the four secondary spirals the subsutural, 2d, appears at the middle stage of the first whorl, the middle one ,2g, at the end of that whorl, and the lowest ,2f, and the upper ,2h, on the second whorl. The tertiaries appear on the third or the later whorls. On the later whorls the two major spirals ,1a and 1b, form the laterally elongated tubercles on the crossing with the plicae. The penultimate or the ultimate whorl is ornamented by the additional quatery and the lower-order spiral lines. The penultimate whorl is angulated at one-fourth and three-fifths from the lower suture. The surface above the upper angulation, (b), is slightly concave or almost flat and steeply sloping; that between the angulations is markedly concave and vertical or somewhat sloping; and that below the lower angulation is concave and receding. The spiral threads on the adult whorls are regularly spaced and alternated by the fine with the minute



Text-fig. 1. Early whorls of the related species of *Granulifusus*
a-b, *G. dualis* (Yokoyama)
c-d, *G. matsumotoi* n. sp.
e, *G. kiranus* Kuroda (MS)
f, *G. niponicus* (Smith)
g, *G. musashiensis* (Makiyama)

1) 宮崎県児湯郡三財村小豆野

ones. The suture is appressed. The base is necked and sculptured by the numerous threads of which the primaries are weaker and the secondaries are somewhat stronger than those on the lateral surface. The aperture is fusiform with the long canal which hardly bends sideward. The fasciole is not so doveloped. The inner lip is simple and smooth with thin callus; the outer lip is thin with a plica outside.

Comparison:—The new species is allied to *G. dualis* (YOKOYAMA), especially to the bi-angulate form of it. The two species have the equal geological range and occur at the same localities, though *G. dualis* occurs much more frequently than the new species does. In *G. matsumotoi* n. sp. the angle-forming primary spirals are 1a and 1b, but in the bi-angulate specimens of *G. dualis* they are 1a and another additional lower primary 1e. In some cases 1e of the latter species appears at the beginning of the first whorl, gradually approaches the lower suture and at last conceals itself under the following whorl in the later stage, and in other cases, on the centrary, it is not visible from outside under the cover of the next whorl at the first stage and then crops out from that cover. Accordingly the lower angulation of the bi-angulated form of *G. dualis* is close to the suture and that of *G. matsumotoi* is at the lower one-fourth of the whorl-height (text-fig. 2 *dualis* a and *matsumotoi*). Other differences between the two species are as follows. *G. matsumotoi* has less numerous whorls and the axial plicae.

G. kiranus KURODA (MS) (KIRA, 1954, pl. 30, f. 3) is another ally to this new species. The former is one and a half times larger than the latter. Though both are bi-angulate and the surface above the upper angulation is nearly flat, the spirals on the ramp are quite different. 1c is hardly stronger than the secondaries in *G. matsumotoi*, but in *G. kiranus* not only 1c but also 2d is remarkably stronger than the other secondaries and approximately show the tri-angulate appearance. Furthermore the position of the main angulations is closer to the lower suture in *G. kiranus* than in *matsumotoi*. In spite of these differences the two so closely resemble each other in general outline and ontogenetic feature that it is naturally concluded that they have some phylogenetical relation.

"*Fusus rufinodis* v. MARTENS subsp. *timorensis* forma a" (KOPERBERG, 1931, S. 90, T. 2, F. 32) is another ally to the present new species, but the two are readily distinguished by the following difference. The former is slightly larger than the latter and has stronger axial plicae and threads inside of the outer lip. Moreover the secondary and the tertiary spirals of the former are very weakly depressed.

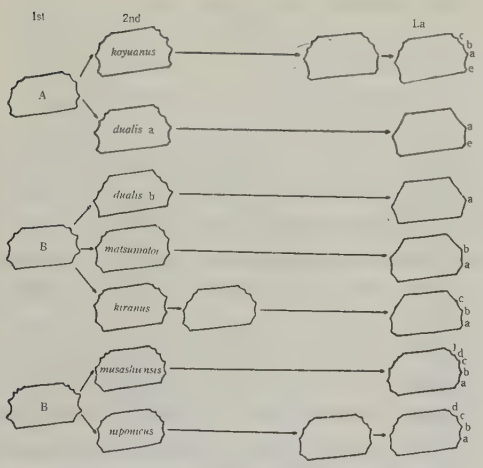
Horizon:—The middle part of the Takanabe member (Lower Pliocene).

Locality:—Hagenoshita,[1] Uwaye mura, Koyu gun, Miyazaki Prefecture.

Evolutional Lineage of *Granulifusus*

I compared the general form and ontogeny of six known and two new species to realize the phylogenetic relation among them. Among the known species *G. kiranus* KURODA (MS), *G. niponicus* (SMITH), *G. musashiensis* (MAKIYAMA) and *G. dualis* (YOKOYAMA) in some sort resemble the new species *G. koyuanus* and *G. matsumotoi*, in the general form.

Accurate comparison of their penultimate whorls reveals the following evidence (text-figs. 2 and 3). In *G. niponicus*



Text-fig. 2. Ontogenetic change in the profiles of the post-nuclear whorls in the selected species of *Granulifusus* (see text p. 260).

1st, 2nd and La mean the first, the second and the last whorl respectively.

the whorls show rather rounded side with four angulations (a), (b), (c) and (d) as above noted. Among four angulations, (d) is considerably weaker in some specimens than the others, which are equally heavy. *G. musashiensis* has the whorl resembling the preceding. However the penultimate whorl of *G. musashiensis* is featured by the additional angulation (j) and by rather flat slope above (c), which in *G. niponicus* is not flat but rounded. In these two species the angulations (a) and (b) are situated at comparatively lower position on the whorl side. In *G. kiranus* the angulations (a) and (b) are heavy and similar to those of the preceding species, however, (c) and (d) hardly indicate the distinct marks of angulation but with rather weak spiral ribs. This results that the surface above the angulation (b) toward the upper suture is almost flat. In other words the flat slope exihibited in *G. musashiensis* is exaggerated in *G. kiranus*. The lower two angulations (a) and (b) lie also at comparatively lower position, namely, at the lower one-ninth and at one half of the whorl-height respectively. In *G. matsumotoi*, though (a) and (b) are also strong, the surface above (b) is quite flat or even concave without any angulation and there exists only a weak riblet at the position coresponding to the angulation (c) of the early whorls. The position of (a) and (b) is a little higher than in the preceding three species, namely, at the lower one-quater and three-fifths of the whorl-height respectively. In *G. dualis* the number of the angulation decreases further. Generally only one but marked angulation (a) is visible at the lower three-fifths of the whorl-height. The surface above the angulation makes a quite flat slope where (b), (c) and (d) are represented by the fine threads and no marks of the angulation except for the somewhat clear elevation equivalent to (b) in few specimens. In a few specimens another angulation (e) is visible close to the lower suture. *G. koyuanus* is provided also with the distinct angulation (a) and (e) at almost the same position as in the preceding form. In this species the angulations (b) and (c) are hardly developed on the slightly convex surface above (a), though the ribs corresponding to these angulations are moderately strong and even spinose.

From the above mentioned facts I directly recognize certain resemblance of the form of the adult whorl between *G. koyuanus* and *G. dualis*, between *G. matsumotoi* and *G. kiranus* and that between *G. niponicus* and *G. musashiensis*. Apparently the second group is the intermediate form between the first and the third group.

What is the ontogenetic expression of these characteristics of the adult mor-

Table 2. Comparison of the morphological characters, dimensions and geological age of the selected species of *Granulifusus*.

In the column of axial plice f, p. and u denote the first post-nuclear, the penultimate, and the ultimate whorl respectively.

The height and the maximum diameter are given in mm, and the apical angle in degrees.

Granulifusus species	number of whorls / protoconch	axial plicae	penultimate whorl: distinct spiral threads	penultimate whorl: side	height	diameter max.	apical angle	age
G. niponicus (SMITH)	9 / 1.5	f 12 p 11 u 12–13	3		47	17	39–41	Recent
G. kiranus (KURODA)	8.5 / 1.5	f 12 p 13 u 14–15	3		45	17	42	Recent
G. musashiensis (MAKIYAMA)	7.5 / 1.5	p 12–15 u	3		33	11	43	Pleistocene
G. makiyamai (OTUKA)	8 / 2	p 15 u	6		28	10	38	Pleistocene
G. dualis (YOKOYAMA)	8 / 2 / 1.5	f 12–11 p 11–12 u 13	1		38	14	43–45	Early Pliocene
G. koyuanus n. sp.	8 / 1.5	f 12 p 10 u 11	2		32	11	40	Late Miocene
G. matsumotoi n. sp.	7–7.5 / 1.5	f 12 p 10–12 u 11	2		33	12	40	Early Pliocene

phology among these species?

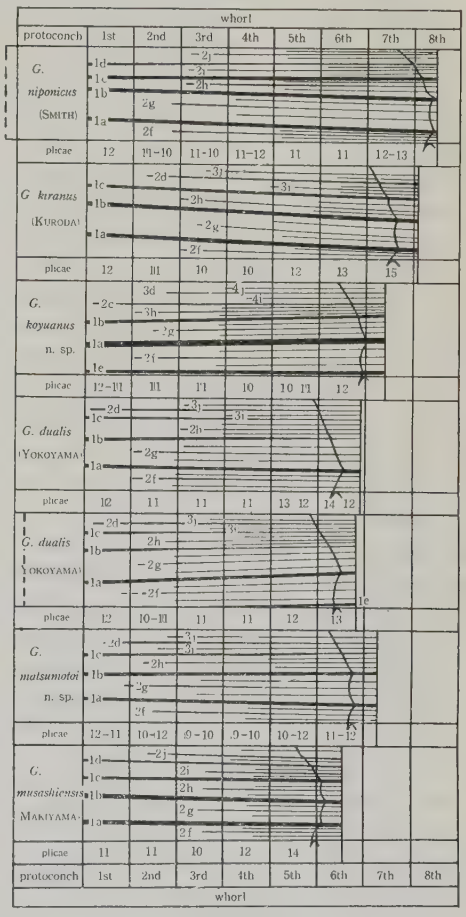
The protoconchs of the five forms consist equally of about one and a half whorls of rounded and smooth profile and the fluctuation in that number is only of minor extent, at most a quater whorl, and is observed very rarely. Thus, concerning with the protoconch, the apparent different is not found among the species.

The obervation of the ontogenetic change of the profile of the post-nuclear whorls offers an interesting evidence. As indicated in text-fig. 2, the first post-nuclear whorl shows the depressed octangular outline in all the species. In *G. dualis* the original octangular outline holds during only the first whorl and soon becomes modified hexagonal. Whereas in *G. koyuanus* the octagonal stage continues through two and a half whorls. In *G. matsumotoi* and *kiranus* it lasts untill the gerontic stage with minor modification. The details of the octagonal profile differ between the former and the latter group; that is to say, the angulations (a) and (b) are more widely separated in *G. matsumotoi* group than in *G. dualis* group. The first whorl of *G. niponicus* and *musashiensis* is octagonal of the latter type with a minor modification by the angulation (d), however, on the later whorls the angulations (a) and (b) approach each other and remarkably come forward toward the lower suture altogether. As a result of this change the angulations (c) and (d) become distinct and the whorl shows a

convexedly arched profile. This tendency illustrated in *G. niponicus* is further pushed forward in *G. musashiensis* and greatly excessed in *G. makiyamai*, both of which occur in the lower Pleistocene beds of south Kwanto region. Irrespective of this resemblance, the surface above (c) in *musashiensis* becomes a flat slope, which is one of the characteristic features of *G. kiranus* and the ancient species.

From the evolutionary point of view it may be considered that in *G. dualis* the nepionic stage of *G. koyuanus* is shortened and the late stage of the latter is prolongated and exaggerated and some new characters are added. *G. matsumotoi* and *kiranus* in their adult stage show the nepionic characteristics of *G. koyuanus*. In *G. niponicus*, *musashiensis* and *makiyamai* the tendency illustrated in *G. matsumotoi* is further developed.

In the whole forms majority of the angle-forming ribs appears at the beginning of the first post-nuclear whorl, but some start a little later and others later on. The spirals of earlier-appearance are generally more distinct than those of latter appearance. I define the former group as the primary spirals, the second group as the secondary, and so on. The notation of them is shown as the combination with the symbol of the angulation as mentioned above. In all the forms the primary spirals appear as the spiral rows of the granules on the axial plicae and then at the later part of the first post-nuclear whorl they continue spirally (text-fig. 1). In *G. niponicus* 1a, 1b and 1c are almost equally developed at the beginning and hold their strength throughout the growth stages. 1d (rarely 2d) is slightly less distinct originally than the other primaries and becomes weaker gradually as the shell grows, but it maintains somehow the magnitude of "primary" order. The secondaries appear altogether at the transition between the first and the second post-nuclear whorl, though there are rare exceptions in which cases the upper ones,



Text-fig. 3. Ontogenectic change in the features of the spiral and the axial ornamentation in the selected species of *Granulifusus*.

2i or 2j, tend to be retarded from appearance. *G. musashiensis* has originally four primaries, 1a, 1b, 1c and 1d, of which the upper two are considerably smaller than the others. The secondaries except for the uppermost one, 2j, appear

almost at the middle part of the third whorl and become gradually so weak that they are indistinguishable from the tertiary threads on the late whorls. Whereas 2j starts on the second whorl and becomes as strong as 1d and makes the angulation on the late whorls.

The difference of the ontogenetic features of the spirals between the preceding species and *G. kiranus* is very delicate. 2d of the latter species puts in appearance on the second whorl and the other secondaries follow the tendency of those of *G. niponicus* but with some excession. In *G. matsumotoi* 1c is almost equally developed to the other primaries, 1a and 1b, originally, but becomes weak rapidly and on the fourth whorl it is hardly distinguished from other secondaries or even from tertiaries. 2d appears at the middle of the first whorl with its distict granules, however, it is weakened and dissolved into the threads of the lower order. 2g, 2f, 2h and 2i appear in this order at the stage between the beginning of the second and the third whorl.

In *G. koyuanus* the situation is quite different. The primaries are unequal originally. That is to say, the very strong 1a is acompanied by the much less distinct 1e, 1b and 2c (rarely 1c). The latter three ribs, though weak to compare with 1a, holds their magnitude of the primary or the secondary order unchanged throughout the growth stages and distinctive from the threads of the lower order. Because the spiral d is delayed untill the second whorl, where it appears as 3d together with 2f, 2g and 3h, 4i and 4j, in return, are retarded and start only at the transition between the third and the fourth whorl.

In *G. dualis*, though the primaries are of the same magnitude originally, only 1a maintains its strength throughout. 1b and 1c, especially the latter, become weak rapidly and thus on the third whorl they are hardly distinguished from the secondaries. 2d appears in some specimens on the early part of the first whorl and in other extremities at the beginning of the third whorl. Among the other secondaries 2f and 2g tend to appear early on the first or second whorl and the order of the appearance of them is rather irregular.

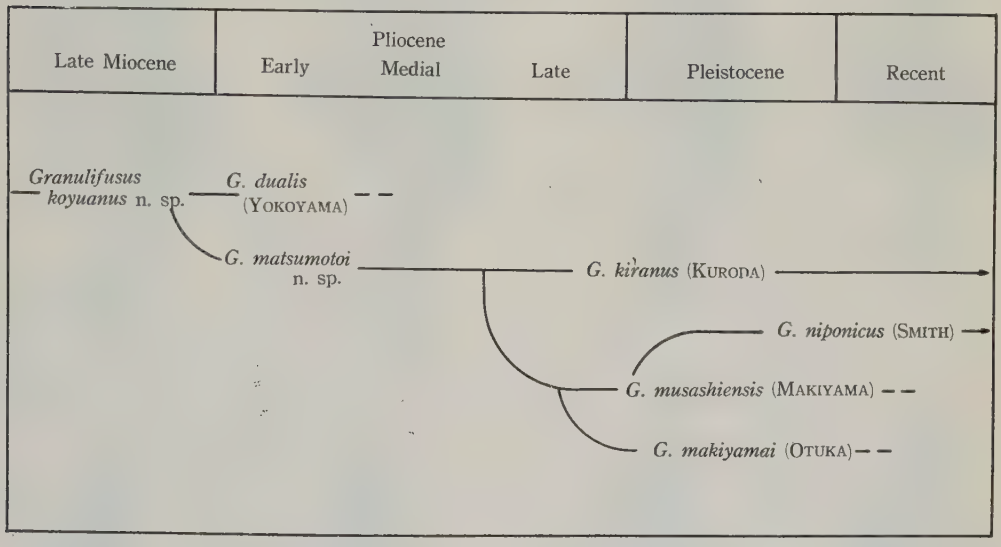
The numer and the strength of the axial plicae are not only different among the species, but also change through the growth stages of each species. In the whole species of *Granulifusus* the plicae are generally heavy in the early stage and become weak at the late stage, especially at the gerontic. However in the majority of the species they hold the strength of real plicae except for *G. niponicus* and *musashiensis*, in which case the plicae are obsolete at the gerontic stage.

The number of the axial plicae is about 12 to 13 on the last whorl (abbreviation, u) and 11 on the penultinate (abbreviation, p) in *G. niponicus*; 14 to 15 (u) and 13 (p) in *G. kiranus*; 11 (u) and 11 (p) in *G. matsumotoi*; 14 to 15 (u) and 12 (p) in *G. musashiensis*; 11 (u) and 10 (p) in *G. koyuanus*; and 13 (u) and 11 to 12 (p) in *G. dualis*. In the whole species a common tendency is observed that the plicae once decrease in number by one or two on the nepionic and the adolescent whorls and then again increase in the adult and especially in the gerontic whorls by one to three. Concerning the number of the plicae there is not any marked difference among the species at the early and the middle stage of the growth, and the deviation is observed only in the late stage, when the number is slightly fewer in *G. koyuanus* and *G. matsumotoi* and remarkably greater in *G. musashiensis*

and *G. kiranus*. *G. dualis* and *G. niponicus* have the intermediate number of the plicae.

In concluding the foregoing considerations of the adult form, ontogenetic change in the whorl profile and in the features of the spirals andthe axials, I readily recognize the phylogenetic rela-

Table 3. Preliminary scheme of the phylogeny of the Japanese species of *Granulifusus*. The position of the recent species *G. gemmulata* KURODA in these lines is not clear.



tion between *G. dualis* and *G. koyuanus*, that between *G. matsumotoi* and *G. kiranus*, and that between *G. musashiensis* and *G. niponicus*. These three stocks, in return, have interesting phylogenetic relation of higher category. Of course the phylogeny of one form should be considered on the basis of all the known species including the foreign ones. However I have not any detailed data concerning the foreign species, then I offer here a result of the preliminary consideration of the phylogenetic relation among the Japanese species of *Granulifusus*. The following table is a tentative scheme of the phylogeny of them.

In the case that these phylogenetic relation is true, the ancestral *G. koyuanus* evolved to *G. dualis* by "hypermorphosis" and to *G. matsumotoi* stock by "neoteny". It is a very interesting that on one hand *G. dualis*, a result of hypermorphosis, seems not to have any apparent discendants, on the other hand *G. matsumotoi*, evolved by neoteny, left the diversified discendants.

Aknowledgements

I wish to express my hearty thanks to Professor T. MATSUMOTO of Kyushu University for his effective guidance in this serial study.

I am much obliged to Professor R. TORIYAMA of that University for his aid in the course of the study and reading over the typescript.

I am also indebted to Dr. KURODA of Kyoto University for his valuable advices on the classification of the present genus and for giving me access to the specimens of the recent species.

Mr. M. Inouye of Mitsubishi Mining Company Ltd. gave me many precious fossil specimens.

This study was partly financed by a grant from the Science Research Fund of the Ministry of Education.

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Explanation of the plate 38

Granulifusus kiranus Kuroda (MS) ..... p. 258
Fig. 1 (×1.5), living, loc. off Kôchi Prefecture.

Granulifusus niponicus (Smith) ..... p. 254
Fig. 2 (×1.5), living, loc. off Wakayama Prefecture.

Granulifusus matsumotoi n. sp. ..... p. 257
Figs. 3 and 7 (×2), holotype, GK-L 15101, loc. Hagenoshita, Uwaye mura, Koyu-gun Miyazaki Prefecture.
Figs. 4 and 8 (×2), paratype, GK-L 15102, loc. same as the preceding one.

Granulifusus dualis (Yokoyama) ..... p. 254
Figs. 5 and 10 (×2), GK-L 15081, loc. Hagenoshita, Uwaye mura, Koyugvn, Miyazaki Prefecture.
Figs. 6 and 12 (×2), GK-L 15075, loc. same as the preceding one.
Fig. 11 (×2), GK-L 15074, loc. Tôriyama, Kawaminami mura, Koyugun, Miyazaki Prefecture.

Granulifusus koyuanus n. sp. ..... p. 257
Fig. 9 (×2), holotype, GK-L 15091, loc. Azukino, Sanzai mura, Koyu gun, Miyazaki Prefecture.
Fig. 13 (×2), paratype, GK-L 15094, loc. same as the preceding. The outer layer of the shell is removed in this specimen.

Photos by T. Shuto


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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 31, pp. 265-269, pl. 39, Aug. 15, 1958.

347. STRATIGRAPHICAL AND PALEONTOLOGICAL STUDIES OF THE LATER PALEOZOIC CALCAREOUS ALGAE IN JAPAN, XIII

—A restudy of the genus *Physoporella**—

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Physoporella 属の再研究：岐阜県大野郡丹生川村を東西に流れる小八賀川の両岸に，二畳系の石灰岩がよく発達して居り，東京教育大学の猪郷久義によって詳細に調査されている。猪郷は該石灰岩中から，保存極めて良好の石灰藻化石を多く発見し，その研究を私にまかせて下された。私はその研究中 1903 年 G. Steinmann が創定し，のち J. V. Pia が再検討した *Physoporella* 属を，限定された *Physoporella* と新属 *Clavaphysoporella* の 2 つに分割する必要を見出したので，茲に報告する。新属の模式種は *Physoporella minutula* Gümbel で，この新属に入る新種として，丹生川村附近から 5 種が発見されているが，その中，*Clavaphysoporella faceta*, *C. fluctuosa*, 及び *C. comforma* の 3 種を茲に発表することとした。

遠藤隆次

Introduction and Acknowledgement

Very good Permian fossil localities are found along the Kohachiga River in the Hida Massif, Gifu-ken, whose center is located at 36°10′N. L. and 137° 22′E. L.

Hisayoshi Igô of the Tokyô University of Education, who recently made very careful field observations, used a term "Nyûgawa group" to embrace all Permian strata in this district, tentatively dividing the succession into Ozu, Gonbô and Chôshidani formations in descending order.

Igo has also been studying in detail fusulinid specimens collected in this region, using more than 300 thin sections.

In the course of this study, he found that relatively many of these sections contained a great deal of well-preseved algal specimens, which he kindly forwarded to me for study.

I take this opportunity to express my gratitude for Igô's cordial friendship and also for the financial help rendered by the Ministry of Education.

Physoporella, emended and *Clavaphysoporella*, new genus.

In 1903 G. Steinmann established genus *Physoporella* on *P. pauciforata* from the Triassic formations of Alps district, Europe, and successively, in 1922 J. V. Pia redefined the generic features are as follows. "Stabförmige Dipploporen mit piriferen, in Wirteln gestellen, unverzweigten Ästen. Bei der Bestimmung ist weniger darauf gewicht zu legen, dass allen Poren gegen aussen geschlossen sind, als vielmehr darauf, dass überhaupt sicher geschlossen Poren auftreten und dass die form derselben sich durch die Zurundung des distalen Endes dem piriferen Type anschliesst. Die Wirtel sind häufig gedrängt bis zweizeilig. An der Schale ist eine Glie-

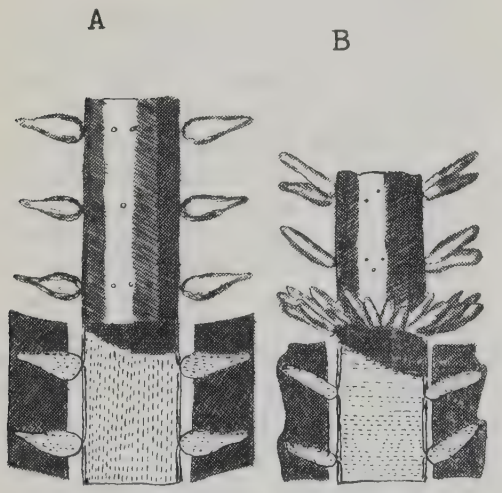
* Received Feb. 17, 1958; read at the 69th Meeting of the Palaeontological Society of Japan, Feb. 2, 1958, at Sendai.

derung durch Annulation oder Fissuration häufig entwickelt oder es macht sich Undulation bemerkbar."

Almost at once Gümbel and Pia identified as *Physoporella* other cylindrical thalli with outwardly somewhat expanded stick-shaped pores. After careful examination of all the species of the so-called *Physoporella*, previously described by Gümbel, Pia and myself, I have now come to recognize that the so-called *Physoporella* be re-emended in accordance with some more advanced method of classification.

Physoporella is proposed to include the species congeneric with *Physoporella pauciforata* Gümbel which has pirifer type pores (see Text-fig. A). While I choose *Physoporella minutula* Gümbel as the genotype of *Clavaphysoporella* established as a new genus in this paper. Its diagnoses are as follows.

Diagnoses:—The thallus is cylindrical, relatively straight and consisting of fine annulations. It sometimes shows slight innerannulations. The pores are relatively slender, and usually somewhat expanded toward the exterior, and enclosed in the calcareous body, that is, they show all the characteristics of the so-called phloiophor type, and they are moderately ascending toward exterior. The pores are arranged as definite whorls which are assembled into two or three gathered lines and make cluster-like appearance. (see Text-fig. B)



Reconstraction of *Physoporella pauciforate* (after Pia).

Reconstraction of *Clavaphysoporella minutula* (after Pia).

Classification:—According to the above discussion, I proposed to separate all species of so-called *Physoporella* previously described into the following two groups.

Physoporella, emended
- *Physoporella panciforata* Gümbel (Text-fig. A)
- *P. dissita* Gümbel
- *P. praealpina* Pia
- *P. praealpina* var. *lotharingia* Ben.
- *P. japonica* Endo
- *P. kitakamiensis* Endo

Clavaphysoborell, new genus
- *Clavaphysoporella minutula* (Gumbel) (Text-fig. B)
- *C. elegantannulata* (Endo)

I identified the following five new species which must be inserted into new genus *Clavaphysoporella* from Nyûgawa district.

Clavaphysoporella faceta, *C. fluctuosa*, *C. conforma*, *C. similis* and *C. nanus* from which I described here three species that are more important.

For symbols used for measurement in this report, readers are advised to see the writer's description of later Paleozoic calcareous algae in Japan I–X.

Family Dasycladaceae

Clavaphysoporella, new genus

Clavaphysoporella faceta, new species

Plate 39; Figures 1-5.

Measurements	D	d	P	Height of each annulation	W
No. 606	2.052 mm	1.188 mm	0.095 mm	0.540 mm	
No. 609	1.404	0.675	0.095	0.513	
B_1 21049	1.863	0.810	0.081	0.675-0.810	
P_3 21055	0.999	0.351	0.068	0.378	
No. 607	1.080	0.729	0.056		30±

Five specimens have been selected as described types from a number of well-preserved specimens that were available.

The longest specimen on hand is estimated to be 5.2 mm in length.

Description:—The thallus is cylindrical, straight and consists of fine annulations. The annulated body shows rather deep furrows which reach sometimes to the deepest part of the calcareous body.

The pores are given off from the central stem at relatively narrow basement and they retain their width outwardly into the rounded terminations which are sometimes enclosed in the algal body, or otherwise opend to the exterior; they are slightly ascending toward the exterior and finely arranged as a cluster.

Comparison:—As seen from the above description, the present specimens may be allied to *Clavaphysoporella minutula* (Gümbel) from European Triassic formation; one will note, however, that they are easily distinguishable by the presence of fine annulations and more finely clustered pores.

Occurrence:—Ôzu and Gonbô formations (upper and middle parts of the Nyûgawa group): limestones (H. Igo's Locality No. B figs. 2, No. P2 figs. 3 and No. K3 figs. 1, 4, 5.) in the Horadani valley (B1), Choshidani (P3) and Sote (K3), Nyugawa-mura, Ôno-gun, Gifu-ken, Japan.

Holotype:—D. E. S., Saitama University, Slide Nos. 606 and 607.

Paratype:—Geol. Min. Inst. Tokyô Kyôiku Daigaku, Reg. Nos. 21049 and 21055 and D. E. S., Saitama Univ. Slide No. 609.

Clavaphysoporella fluctuosa, new species

Plate 39; Figures 6 & 7.

Measurements	D	d	P	Height of annulation	W
L2 21044a	1.89 mm	0.756 mm	0.108 mm	0.513 mm	
L2 21044b	1.89	0.81	0.135		28±

This species is represented by one well-preserved longitudinal section and an associated half part of somewhat oblique cross section. The longest specimen on hand is estimated to be 7 mm.

Description:—The thallus long, broadly cylindrical and consisting of very fine outer annulations as well as slight inner annulations. The outer annulations show wide and deep furrows which sometimes reach the central stem. The pores 0.675 mm long and given off from the central stem at the slightly broader basement which gradually diminish into rather pointed terminations. The pores are moderately ascending toward the

exterior and constitute fine cluster. On whorl of clustering pores may be contained in each annulation. No reproductive organs described.

Comparison:—The present species differ from all species of this genus previously described in having fine broader annulations and stout, long pores. Therefore, I am not acquainted with any European, American or Asiatic species with which this species is likely to be confused.

Occurrence:—Gonbô formation (middle part of the Nyûgawa group): limestone (H. Igo's Loc. No. 12) at Hatahoko, Nyûgawa-mura, Yoshiki-gun, Gifu-ken, Japan.

Holotype:—Geol. Min. Inst., Tokyo Kyôiku Daigaku, Reg. No. 21044.

Clavaphysoporella conforma, new species

Plate 39; Figures 6 & 7.

Measurements	D	d	P	Height of annulation
B1 21048a	0.999 mm	0.405 mm	0.054 mm	0.594 mm
B1 21048b	1.404		0.081	0.702

Although the present species is represented by only one longitudinal section and an associated detached annulation without any cross section, the specific features are clear.

Description:—The thallus straight, cylindrical and moderately undulating. It shows fine outer annulations and slight inner annulations. The pores are slender, and are given off from the stem cell at the slightly broader basement which gradually diminishing into relatively slender terminations. The pores are moderately ascending toward the exterior .and constitute fine clusters. The outer annulations of the present species are remarkable by the presence of wider and deep furrows which reach

Explanation of Plate 39

S. N.=Slide number

Figs. 1-5. *Clavaphysoporella faceta*, new species, ×25.
1. A longitudinal section of a very fine specimen, showing the cluster-like arrangement of the pores. (S. N. 606)
2-4. Three somewhat oblique longitudinal sections. (S. N. 609, 21055, 21049)
5. A cross section relatively well-preserved. (S. N. 607)
Ozu and Gonbô formations (Upper and Middle parts of the Nyugawa group): limestone (H. Igô's locality No. B1—figs. 2 and 3, No. K3—figs. 1, 4, 5.) in the Horadani valley (B1) and Sote (K3) Nyûgawa-mura, Ôno-gun, Gifu-ken, Japan.

Figs. 6-7. *Clavaphysoporella conforma*, new species, ×25. (S. N. 21048)
6. A longitudinal section comparatively well-preserved.
7. An associated detached annulation. Occurrence same as figs. 2 & 3.

Figs. 8-9. *Clavaphysoporella fluctuosa*, new species, ×25. (S. N. 21044)
8. A well-preserved longitudinal section, showing deep-engraved sinuations and long club-shaped pores.
9. A half part of an associated cross section. Occurrence same as figs. 2 & 3.

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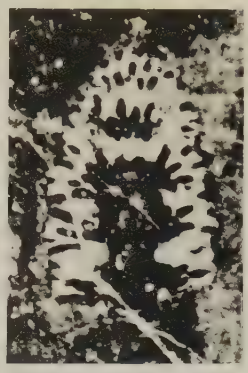

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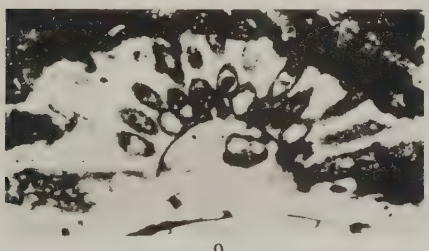

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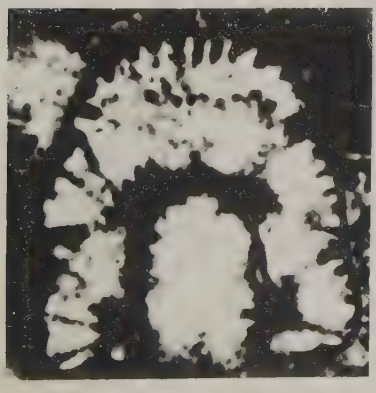

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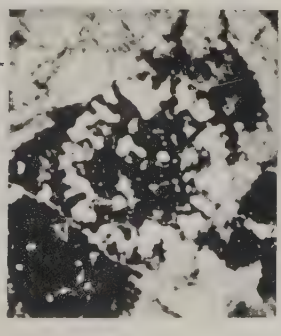

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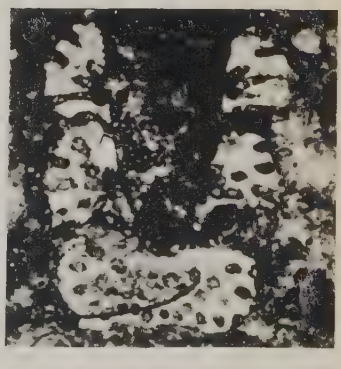

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the middle part of the calcareous body.

Comparison:—The general appearance of this species can be compared with *Clavaphysoporella faceta* from the same locality though it is distinguishable by its annulated furrows which are wider and relatively shallower and its pores clustering regularly.

Occurrence:—Ôzu formation (Upper part of the Nyûgawa group): limestone (H. Igô's Loc. No. B1) in the Horadani-valley, Otani, Nyûgawa-mura, Gifu-ken, Japan.

Holotype:—Geol. Min. Inst. Tokyô Kyoiku Daigaku, Reg. No. 21048.

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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

「日本古生物学会第69回例会」1958年4月26日新潟大学理学部地質鉱物学教室に於いて開催した(参会者21名)。例会に於ける講演者並びに講演題目は次の通りである。

1. イワムシの生痕の研究(その III) ....歌代 勤
2. 塩ノ沢産の *Bakevellia ussurica* KIPARISOVA var. *rostrata* YABE について(代読) ....中沢圭二
3. Late Triassic Pteriacea from Atsu and Mine Series, West of Japan (代読) ....Akira TOKUYAMA
4. Late Triassic *Palaeopharus* in Japan....Akira TOKUYAMA
5. 岐阜県栃尾地域の手取層群産 Polymesoda について(代読) ....前田四郎
6. 赤岩亜層群産非海成動物化石群について(代読) ....前田四郎
7. *Palliolum peckhami* の時代的変異におけるいくつかの問題 ....歌代 勤
8. Nomenclatural Review of Genera and Subgenera of Lucinids, with Remarks on Certain Genera (代読)....Katsumi HIRAYAMA
9. Review on the Classification of the Family Lucinidae (代読) ....Katsumi HIRAYAMA
10. Revisions on the Japanese Species of the Genus Lucinoma (1) (代読)....Katsumi HIRAYAMA
11. A Pleistocene Marine Fauna near the Cities of Tsu and Yokkaichi, Mie Prefecture, Southwest Japan (代読) ....Yoshio ARAKI
12. 下層累層の動物群 ....津田禾粒・本間信一
13. Kurosedani Fauna ....津田禾粒
14. Some Miocene Species of *Calliostoma* in Japan....池辺展生・津田禾粒
15. Supplementary Descriptions of the Liassic Pelecypods from the Kuruma and Shizukawa Groups in Japan. (Studies on the Liassic Pelecypods in Japan, 9) (代読) ....Itaru HAYAMI
16. Some Ordovician Fossils from the Thailand-Malayan Borderland ....Teiichi KOBAYASHI
17. *Callianassa shikamai* IMAIZUMI, 1957 の新産出(代読) ....今泉力蔵
18. 新潟県産小滝炭の構成植物 ....島倉己三郎
19. 新潟県新津油田の花粉分析 ....島倉己三郎
20. 相川・門前階における古気候考察に関する一資料 ....西田彰一・高橋信雄
21. 関植物化石群の組成 ....藤岡一男・西田彰一
22. 佐渡関植物化石層の層位..西田彰一・藤岡一男
23. *Parrotia fagifolia* (UNGER) HEER と日本におけるその産出層準 ....藤岡一男

NEWS

XXI Session, International Geological Congress は Denmark, Finland, Iceland, Norway, Sweden 等北欧 5 ケ国の共同主催で 1960 年 8 月 15—25 日に Copenhagen で開かれることになった。この会議の研究発表会や討議は次の 20 部門に分かれて行われる事になっている。

1. Geochemical cycle.
2. Geological results of applied geochemistry and geophysics.
3. Pre-Quaternary absolute age determination.
4. Chronology and climatology of the Quaternary.
5. The Cretaceous-Tertiary boundary.
6. Pre-Quaternary micropaleontology.
7. Ordovician stratigraphy and correlations.
8. Late Pre-Cambrian and Cambrian stratigraphy.
9. Pre-Cambrian stratigraphy and correlations.
10. Submarine geology.
11. Regional and structural problems in oil geology.
12. Regional paleogeography.
13. Petrographic provinces, igneous and metamorphic rocks.
14. The Granite-Gneiss problem.
15. Genetic problems of Uranium and Thorium deposits.
16. Genetic problems of ores.
17. Minerals and genesis of Pegmatites.
18. Structure of the earth's crust and deformation of rocks.
19. Caledonian orogeny.
20. Other subjects.

これと同時に International Palaeontological Union や The Association of Sedimentary Petrologists の会合も開かれることになっている。会議前には 48 班，会議後には 43 班の地質巡検が計画されているが，そのうちには遠く Iceland や SW. Greenland まで出かける大旅行も含まれている。2nd Circular の希望者は本年 10 月 1 日までに下記へ申込まねばならぬ事になっている（この用紙入用の向は，日本学術会議古生物研究連絡委員会に申込まれたい）。

The General Secretary, XXI Session International Geological Congrees,
Mineralogisk Museum, øster Voldgade 7,
Copenhagen K, Denmark.

IX International Botanical Congress は 1959 年 8 月 19—29 日 Canada の Montreal で開かれる事になった。同会議には古植物学の部会があるが，会期前の British Columbia の巡検には古植物学的見学が含まれ，会期後のには特に古植物学者の為に 10 日間の巡検が計画されている。連絡先は次の通り：

Secretary-General, IX International Botanical Congress,
Science Service Building, Ottawa, Canada.

京大教授槇山次郎博士は日本学術会議を代表して International Palaeontological Union, London Session に出席することに決定した。

教育大教授藤本治義博士は日本学術会議を代表して IV International Carboniferous Congress (Heerlen, Netherlands) に出席することに決定した。

日本古生物学会例会通知

	開催地	開催日	講演申込締切日
第71回例会	京都大学	1958年9月27日	1958年9月6日
1958年総会,年会	東京大学	1958年12月6,7日	1958年11月15日
第72回例会	広島大学	1958年2月 中旬	1959年1月 中旬

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